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ENGINEERING NEWS-RECORD

DEVOTED TO CIVIL ENGINEERING
AND CONTRACTING

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Editor

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Engineering News-Record is a consolidation of *Engineering News* and *Engineering Record*, effected in 1917.

Engineering News was founded in 1874 by George H. Frost, as the *Engineer and Surveyor*, which title subsequently became the *Engineer, Architect and Surveyor*, then *Engineering News and American Railway Journal* and finally, *Engineering News*, under the successive editorships of D. McN. Stauffer, Arthur M. Wellington and Charles Whiting Baker.

Engineering Record was established in 1877 by Henry C. Meyer as the *Plumber and Sanitary Engineer*. The name was subsequently changed to the *Sanitary Engineer, Engineering and Building Record* and, finally, to *Engineering Record*. During his ownership of the paper, Mr. Meyer was directly responsible for the editorial policy. John M. Goodell became editor in 1902, and was succeeded by E. J. Mehren.

The Contractor was consolidated with *Engineering News-Record* in 1918.

The staff of *Engineering News-Record* consists of

New York: E. J. Mehren, *Editor;* F. C. Wight, *Managing Editor;* M. N. Baker, F. E. Schmitt, R. K. Tomlin, Jr., C. S. Hill and J. W. Shaver.

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Spirit of This Issue

BUSINESS is like a ship. At times it is in much-traveled waters; at others in uncharted seas. Again it is favored by fair weather, and then assailed by mighty storms. In familiar waters and on fair days the sailor's task is easy. A normal amount of watchfulness is sufficient to bring the ship unharmed to port. If the weather is unpropitious, greater precautions are necessary, while if a hurricane comes in uncharted waters, every art and all the knowledge of the seaman are called into play. No opportunity is lost to determine the direction in which safety lies.

The ship of business has recently been in uncharted seas, with a hurricane blowing. Not only the captains but all of the crew have been tensed with anxiety. Whither were they going in the hurried run for safety? What shoals lay in the course? What favorable signs were there of safe harbor or of abatement of weather? —These are the questions not merely of the navigating officers, but of the technical staff and the common sailors, many of whom hitherto have not concerned themselves with navigating problems.

Such being the situation there has been a great and rapid growth of interest in the log and in the charts of business. To satisfy this interest, *Engineering News-Record* has been developing in recent years the records of the construction industry. These will be found, brought up to present date, in the early part of this issue and constitute the distinguishing feature of this the first number of the new year. Normally these statistics are found near the end of each issue, under the heading, "Business Side of Construction."

It is our belief that a comprehension by the three branches of the industry—engineering, contracting and manufacturing—of where the industry stands will help in determining sound policy. Each branch has its own special point of view. One reads caution into the figures; another sees much of optimism. Put together the sentiment welds into that of the entire field. It is important, therefore, that the several views be based on fact. Even then there is plenty of room for variation in interpretation and for going astray. It was in the hope that fact could be made to supplant guesswork that the various records, analysis and index numbers were established. Their hearty welcome by the field shows that they were sorely needed.

That the construction industry may not want for charts, where charts are available, is the spirit in which the *News-Record* has undertaken these contributions.

Much in Small Compass

IN LAYING out its program of business information for weekly publication *Engineering News-Record* has kept in mind that conciseness was desirable. In this the first issue, however, a certain amount of expansion was necessary. It is easy to fill page after page with figures; it is not easy to get at their essence and present it in a few words. Often the truth cannot be fully comprehended unless the underlying data are at hand for use in verification. That is particularly true in scientific studies. But in business matters the summaries or conclusions generally suffice.

Bearing this in mind we have condensed everything to the utmost. The index numbers in a few figures show the whole state of the industry. The "Trend of Business" column packs a solid week's reading into a few paragraphs. Representative bond issues only are listed, since these, selected from a large geographic range, accurately portray the market for public securities. The weekly price and wage reports are sufficient to indicate the trends and the "markets" in the chief building materials, leaving to the first issue of the month the complete listing of prices and of wage rates. Other statistics and business facts are similarly treated. Thus a picture of the situation can quickly be secured—which is what the average reader wants. Specialized magazines and books on finance are available to supply the demands of those who want a knowledge of detail.

What the Figures Show

IT IS not the intention to detail here the indications of the figures presented elsewhere in this issue. They are so clear that they need but little interpretation.

It is worth noting, though, that of the figures which tell the story best, the index figures. The cost index dropped from 231 in January to 168 in December, while the activity for the year (the volume index) is shown to be 88 as against 91 for 1920. Moreover, the cost index was steadily downward.

Probably the most surprising feature of these figures is that the volume of work placed under contract was within 3 points of what it was in 1920—a remarkable showing in view of the widespread and serious depression. Compared with other industries construction had a good year. It was spotty, it is true. The activity in some lines made up for the inactivity in others.

In the price quotation the most significant feature is the drop of steel to the 1913 level. Structural material at Pittsburgh is now quoted at $1.50, which is also the average for the year 1913. It is interesting to note that the other two major materials have not receded so far. Cement f.o.b. Chicago is now $1.97 as against $1.19 in 1913. Lumber, Southern pine, New York base, is now $49, as against $28.50 in 1913.

Labor, likewise, is still well above the 1913 level. For common labor the average for the country, computed by *Engineering News-Record* for 20 cities, is 45 cents, compared with 17, the common-labor wage in the steel industry in 1913.

In the drops for the year steel again leads, the present quotation as against those for December, 1920 being as follows: Steel, $1.50 as against $3 last year; cement, $1.97 as against $2.37; lumber, $49 as against $64; labor, 45 cents as against 60.

The deflation in prices, then, is similar in the construction field to that in the business world at large. It is spotty. Declines have been greater in some directions than in others.

The tendency will doubtless be still downward, but at a slow rate.

Big Projects Past and Prospective

THE FIGURES quoted and referred to in the preceding comment tell in cold fashion the story of the construction year. It is always satisfying, however, to visualize the big accomplishments singly. Unfortunately the instances of great accomplishment in 1921 are very few.

Most notable is the virtual completion of the Miami Conservancy Work. The great job is not done, but the dams are up and in functioning condition. In the next place must come the turning of water through the first of the record-breaking wheels of the great Chippawa power development of the Ontario hydro-electric system. Last, the Delaware River bridge project at Philadelphia was made a certainty by the completion of the preliminaries and the receiving of bids for the main piers.

On one project—the Hudson River vehicular tunnel—a most lamentable delay must be recorded. The work on the under-water section might, but for petty obstruction, be now well under way. Happily, right at the close of the year, the atmosphere cleared and an active continuance of work seems assured.

In work by classes, small housing, highways and miscellaneous public works call for passing mention. In these lay the greater part of the volume of construction in 1921.

As to the coming year, reverting first to groups of projects, it is probable that the three first mentioned will again be in the lead. The demand for small housing is still unsatisfied, the labor situation and the money market both promise to be somewhat easier, so that there is no discouragement of the demand in sight. As for roads and general public works the easing of the bond market gives promise of great activity.

Of big projects immediately in sight there are none so far as assurance of immediate construction is concerned except the new Cleveland passenger terminal. But there are three in the project stage that are notable. They are all of the grand type, requiring broad vision to conceive and detailed engineering talent and large money expenditure to execute. Not one of the three will probably be actually started in 1922, but each one will occupy the thoughts of many engineers whose duty now is not so much to work out the physical details as to convince the legislative mind and the voter of the fundamental necessities. Any one of the three, once started, will rank with the great engineering works of the century and as such the coming year may be noteworthy as the one when they were initiated. The development of the St. Lawrence for power and navigation, the control of the Colorado for irrigation, power and flood prevention and the unification of the port facilities of New York by railway, tunnel, bridge and warehouse construction, all lie ahead of us. Fewer engineers will be connected with them than with such commonplace necessities as curb setting or track layout, but they are concentrated and stupendous efforts toward diverting the powers of nature to the use of mankind and as such they will redound to the credit of engineers.

One more prospect needs to be mentioned in closing—the possibility, if railroad prosperity increases, of resumption of active railroad work. Much is needed. The new Cleveland passenger terminal, previously mentioned, is a case in point. A return of the railroads to the construction market would be an important factor in increasing the activity of engineers, contractors and manufacturers.

What of the Future

AFTER a survey of the past—briefly referred to above and well covered in various sections of this issue—we come to the ever-fascinating question, "What of the Future?"

It divides itself naturally into two heads: What of business generally? What the prospects of construction?

As always there are both favorable and unfavorable factors.

By far the most favorable feature for general business is the return of confidence, a necessary basis for vigorous trade activity. Many factors have contributed to this much desired end—the excellent banking situation, the slower rate of price declines, the partial recoveries in many business lines and the improving international situation. The last is a factor that deserves heavy evaluation. The certainty of arms reduction, the Four-Power treaty regarding the Pacific, the expected settlement of the Irish difficulty, the general improvement (except in fiscal systems) in the central countries of Europe have had a powerful influence on the popular mind.

The banking situation, particularly, is good. Loans are in moderate amount only and the potentiality for credit expansion within sound limits is very great. Money for investment is in liberal volume, as the rise in bond prices strikingly shows.

Of unfavorable factors there are many. Export demand has fallen off. Taxes are still high, though the new tax bill gives a greater measure of relief than is generally believed. The tariff is in an unsettled condition, making for uncertainty at a time when there is great fear of an invasion of cheap European goods.

Most potent of all the adverse factors is the plain fact that the public is not buying beyond necessities. Here again two situations are to be recognized—that of the farmers, and the state of mind of the city folk. The former have had a bad year. Farm-product prices have been lower than the cost of production. The farmer's buying power has been curtailed, and this, spread over a large area, has a serious effect on trade, for the farm population forms 45 per cent of the whole.

As to the city population, allowance must be made for unemployment and for wage reductions. But other factors are really more important. Prices are still believed to be high; the people have learned that they can get along without many things and are voluntarily accepting a lower standard of living; there is widespread resentment against profiteering, particularly by retailers and by labor, and a desire by withholding purchasing to punish those believed to be guilty. If anyone doubts the actuality of these buying deterrents, let him ask a dozen housewives and a dozen homeowners whether they are holding back purchases for home refurnishing and house renovation, repair and painting.

With these factors existing and operating, what of the coming year?

If one tried an accurate weighing and balancing, we are inclined to believe that he would look for a slow year. However, if the situation be appraised broadly, we believe that much weight must be given to relatively intangible, but, to us, potent factors—the upward trend of the last four months and the striking recovery of confidence. These potent factors combined with the encouragement of business afforded by the financial situation are likely to revive industrial expansion and certainly will encourage new commercial enterprises. These alone promise a recuperating year, with gradually increasing business activity, but not a boom. There is likelihood that the public's pressure for lower prices, for reduction of the spread between production cost and retail price, for the deflation of wages commensurate with deflation in prices will continue. Meanwhile buying is likely to pick up only slowly. Farm buying can hardly be expected until summer. With the public purchasing conservatively activity will depend upon operating and maintenance factors. Years of big business are made by expansion. Happily the basis is sound. Confidence has returned.

Construction Outlook

IN THE construction field the outlook is rather more encouraging than for business as a whole. This is due to the excellence of the bond situation, favoring security sales by governmental authorities, and to the still unsatisfied demand for housing—a demand forced by necessity.

Except for the curtailment that may come from refusal of citizens to stand further tax burdens there is no serious adverse factor in sight in public-works construction.

In building work labor is still high, so are many materials. Nevertheless prices and wages even higher than at present failed to be a serious deterrent to house building in 1921. With the more favorable factors in the general business situation, with wage reductions such as were consequent upon the Landis award at Chicago and the mitigation of the execrable working agreements both in Chicago and in Eastern cities, which are bound to follow the awakening of public indignation against these abuses, the volume of building should exceed that of last year.

Still, there is no reason for wild optimism in the construction industry. On the other hand there is no reason for pessimism. Expectation of steady improvement seems to be warranted by present conditions and the reasonable prospect of effective action by the public against building-labor and building-material abuses.

Changing View on Labor Solution

OF IMPORTANCE in the future adjustment of industrial relations is the present attitude toward the American Federation of Labor. The favor which it enjoyed before the war has largely disappeared. The former sympathy which seemed to be growing has been lost. The middle classes, who have had to submit to salary reductions and have suffered because of strikes, resent labor's tactics in trying to maintain its war scales.

The enthusiasm for the so-called "American plan," the growth of "open shop" sentiment, the public approval at Chicago of the Citizens' Committee for enforcing the Landis award, and the support at New York of the Lockwood Committee's determination to put a stop, by legislative action if necessary, to labor abuses are all indications of this increasing lack of sympathy with the Federation's methods.

While before and during the war there was a feeling that satisfactory industrial relationships could be worked out by having the employers work sympathetically with the Federation, to the end that there would develop there a diplomatic leadership, the view now is that there is little hope of displacing the fighting group, and that employers had better look to developing a personal relationship with their employees. The establishment of plant employee organizations, without affiliations with the Federation, has been growing apace, based upon the theory of former days that the employer is the natural leader of his men.

Large labor bodies would lose their reason for being if the employers would take the leadership of their men and justify that leadership by frankness and fair dealing. In this direction a satisfactory industrial order could be worked out without having our country go through the throes that have afflicted England. By progress in this new direction, it is quite likely that the Federation may be brought to see the light, that intelligence may supersede force, and that the Federation may come at a later date to deserve public confidence. Just now the leadership is so selfish that the paramount right of the public is not recognized.

Whatever the attitude of the public over a long period

of years may be, this much is certain, that the resort now to serious strikes to maintain the war labor scales has not the sympathy of the public. In fact, the public is determined that the wage level shall be lowered. That attitude might not have developed had the Federation preached efficiency and urged that each man render a service adequate to the war wage. The golden opportunity was lost. Even now a change in front would save much, but such counsels fall on deaf ears.

Railroad Revival

ONE of the most remarkable business features of the year was the financial progress of the railroads. Against a deficit in 1920 they will show a net operating income for last year of about $550,000,000. This is truly a heroic result in the face of declining revenues. For the first ten months of the year the gross revenue was $4,672,000,000 as against $5,082,000,000 in 1920. The showing was made, therefore, by reduction in operating expenses. These totaled $3,880,000,000 for the first ten months, against $4,808,000,000 for the same period of 1920. The largest item in this expense reduction was in payroll, but there have been in addition heavy temporary savings through the deferring of maintenance.

But even the net of $550,000,000 is only about half the net earnings intended by the Transportation Act. The act contemplated a return of 6 per cent; the net for 1921 is about 3 per cent. That was not sufficient, for the railroads as a whole, to cover interest on the bonded debt and other fixed charges.

While, therefore, there is reason for congratulation upon the progress that has been made, the railroads are not yet "out of the woods." Nor is it certain that their rate of progress will continue. With further business revival, traffic should increase. However, there is strong pressure for rate reductions. If these can be kept within safe limits—where they will be offset by wage reductions and traffic increases—the progress will go unhalted. Too drastic rate reduction, however, would be unfortunate for the railways and unwise for the country. A prosperous railway system will contribute much to general prosperity.

The railroad companies themselves recognize the need for lower rate reductions and have coupled their most recent request for lower wages with a promise to pass the savings to the public in the form of rate decreases. Judging by the summer decision of the Railway Labor Board and the later rulings abolishing certain wasteful working agreements and changing over-time rules for the maintenance-of-way forces it is apparent that that body, too, appreciates the necessity of bringing railway wages into harmony with the general wage deflation.

If these wage reductions can be made to accompany rate reductions and business at the same time increases last year's favorable progress may be continued.

Scandals in the Building Industry

DURING the whole of last year the country was treated to a succession of exposures of malpractice in the building industry. Materials men and labor unions had their rings whose ultimate result was to levy an undue toll on the public. In consequence there has been a great popular indignation against the whole building industry and not merely against those who were guilty of the collusive practices. Contractors as well as the materials men and the labor unions have come in for condemnation. Not only that, but the stage has been well set for the enactment of restrictive legislation.

We had hoped that contractors would play a large part in bringing to book those who had been responsible for the scandals. In that we have been disappointed. No single group is more aware of what is going on than the contractors. Had they the courage they could, we believe, so command public support as to prevent a repetition of the practices exposed.

On account of the inaction exhibited by the contractors, however, we are inclined to believe that they cannot be expected to take the leadership in fighting these practices. The public must turn to civic organizations, chambers of commerce or to emergency committees such as the Chicago organization of citizens for enforcing the Landis award. In New York, the Lockwood Committee is apparently going to fulfill the same function, and, in fact, has threatened to appeal to the Legislature for restrictive measures to curb the bad practices of the unions. The engineers can help to activate the civic body. Nor do we despair entirely of the contractors. They have fallen down woefully, but many of them, once the opposition is aroused, can be counted upon as valuable helpers to a citizens' vigilance committee.

Certain it is that the revelations in New York and Chicago point to the necessity in every community of investigating the building situation. We know from long experience that the building trades have carried things with a high hand and that building materials distributors get together with greater ease than almost any other class of commercial men. Scandals similar to those disclosed in New York and Chicago are awaiting disclosure in many of the large cities. For the stabilization of building, for the winning of public confidence and the warding off of legislation which may seriously cripple the industry, vigorous action is needed. Delay will only result in explosions that are destructive of public confidence.

The local engineering societies and courageous contractors have a duty to start the wheels of inquiry into motion.

Society Action and Inaction

DURING 1921 society activities absorbed far less of the engineer's time and attention than in the two years just preceding. Then there was agitation in the American Society of Civil Engineers, the organization of the Federated American Engineering Societies and the close scrutiny of the aims, methods and membership of the American Association of Engineers. Now there is a settling down to work, a maturing after the organizing and expansion throes.

In the American Society of Civil Engineers the new regime has been in power a year. That is not enough time to achieve notable results. There has been a consciousness among the members that there was striving at a certain measure of new activity, but the impress is not a strong one. This much, though, is certain: the membership wants a vigorous program of technical activities, and will loyally support sound leadership in that direction. This attitude is a great improvement

over the temper of the years of internal contention. The bickerings seem to have passed. The way is prepared for sound technical functioning if the leadership is forthcoming.

In the activities of the Federated American Engineering Societies likewise, there has been little to stir the blood; and this is said with full realization that the "Waste in Industry" report was produced. That was a worthy work, but either because of its character or because of failure in salesmanship it did not strongly grip the individual engineer. Possibly the subject was too old for enthusiasm. Keen technical interest in industrial waste elimination wore off when the scientific management boom collapsed after its brief flurry of ten years ago. Such studies now are, to the engineering mind, part of the regular routine of industrial management.

In the minds of engineers generally there stands to the credit of the Federation, beside the waste report, only the continuation of the campaign for a Department of Public Works. That, however, was an inheritance and the Federation is not, and should not be, given full credit for it. None of the other activities of the Federation has made any impression.

The Federation is under immediate obligation to find itself and to accomplish results that will favorably impress the entire profession. Failing to do this it will lose support—for directorates will act in accordance with the views of their members. The Federation faces a test year. It had the waste survey to buoy it up in 1921. Unless it soon finds an activity or a group of activities far more gripping than the waste survey, we look for considerable disaffection, with inevitable change of scope or of organization.

Quite in contrast with the quiet functioning of the organizations mentioned has been the vigorous activity of the American Association of Engineers. With a program that lent itself well to publicity, because of its incidence upon public affairs, it has impressed itself on its membership as resourceful, vigorous and effective. It has been constantly alert. Headquarters have stimulated the local chapters and clubs; the latter, in turn, have pressed large problems upon the parent organization. All in all the impression made is that of an organization pulsing with life, alert to its opportunities, pushing onward with vigor.

Possibly the most significant fact in the year's record is that, despite the increase in dues the slump in membership has not been large. On Dec. 1, 1921, the membership was 22,299 (of which 3,000 were students). This represents a loss of only 1,700 in the year, truly a remarkable showing and one that is contrary to the predictions freely made when the dues were advanced. Apparently the younger members of the profession have felt it well worth while to carry on the association's activities.

Should the A. A. E. continue its vigorous functioning it will furnish a desirable spur to the other two organizations. Along their special lines there is opportunity for work fully as vigorous, though in the case of the American Society of Civil Engineers not as spectacular. Technical work has not as strong an appeal as the rendering of personal or public services. Nevertheless, both the Am. Soc. C. E., and the Federation have much to learn from the vigorous activity of the A. A. E.

A.G.C. Makes Excellent Progress

IN ANOTHER field of communal work vitally affecting construction—that of organized contracting—there has been signal progress. The Associated General Contractors, a war-born organization, has more than justified the enthusiasm with which at the beginning of last year we welcomed its growing power.

It increased its membership last year by 50 per cent, but more than that it has displayed a remarkable ability to sense how it can serve contracting and an equal capability in execution. There has been scarcely an activity in which contracting has been affected in which the A. G. C. has not borne a worthy part. In some movements, like the Unemployment Conference, it has been a valuable and prominent worker; in others, like the fall letting of highway contracts and the proposed standardization of contract documents, it has taken the laboring oar and has been largely responsible for getting the activity under way. It has worked with the railway executives on railway rates; it has called unfair trade practices to the attention of the manufacturers in question; it has been vigilant on legislation affecting construction; it has started to accumulate and disseminate figures that will help the individual contractor conduct his work with a better understanding of business and financial conditions.

Like the A. A. E. it has proceeded on the policy that strength in its subsidiary organizations is an important factor in the strength of the central body; therefore, the relations between headquarters and local associations has been a close one. Where locals were lacking they were organized; weak locals were strengthened by advice and encouragement. As a result, the whole organization is pulsating and vigorous, and the central body has been able to carry into effect, through the locals, the ideas to which the entire group is committed.

This is a welcome situation and promises well for the future improvement of the standards of contracting. That the room for improvement was large, and is still large, is freely admitted. It is fortunate that the association is in the hands of strong leaders. The objects to be accomplished are beyond the ability of any but a vigorous management. That the association has, and continued success, therefore, seems assured.

Controversy Over Practice by Corporations

THE OUTSTANDING professional question before engineers during the year was the controversy over permitting corporations and mixed partnerships to practice engineering. While little has been said about the matter for some months, the controversy is not settled. Both the American Society of Civil Engineers and the Federated American Engineering Societies have committees considering the subject. Both of them are to report this month, and it is not impossible that the controversy may then break out anew.

When the public discussion of the matter ceased neither side had fully convinced the other. If anything, the drift was in the corporation ranks and toward the views of those who contended that the practice of engineering should be restricted to individual registered engineers and to partnerships and corporations composed wholly of engineers. The fundamental arguments

certainly favor those who take the strict professional viewpoint. Moreover, theirs is by all odds the safest course. Those who defend the opposite point of view fall back on the claim that in practice no serious harm has been done the engineering profession by the mixture of professional practice with business. This claim, of course, is most vigorously disputed and both sides make strong cases, one for the lapse in professional attitude on the part of corporations and the other for lapses of individuals. When the case is considered in the light of experience, it is apparent that the character of individuals is the determining factor in their conduct and, therefore, the argument gets nowhere when each side is intent upon exposing the moral delinquencies in the opponent's camp.

The controversy has, we believe, been of value in bringing to the fore the question whether engineers are really concerned in creating a professional status for their calling. It has encouraged an inquiry into fundamentals, which is always valuable. It has emphasized the need for greater communal concern regarding the conduct of individual practitioners, and has brought a realization that it is within the power of engineering organizations to determine what their standing before the public shall be. As a result of the controversy it is now keenly appreciated that engineers have been very indifferent to the conduct of their fellows whether practicing as individuals, partnerships, or corporations. If a strengthening of the sense of the moral responsibility of engineering societies to the public has been brought about, this alone will have made the controversy over the registration of corporations a decided contribution toward professional advancement.

Water-Power Development Lagging

DESPITE hopes entertained a year ago water-power development continues to lag behind its possibilities. High costs of construction (two to four times as great as for steam-developed electricity) continue to be almost prohibitive except where coal is not in competition. It would take many years of operating savings to offset the additional tax that excessive first costs would impress. The tabulation on another page shows that some sizable projects have been undertaken, but that practically all are in the West where water-power is practically the only power possible and where its horsepower cost is relatively low. In the East the new plants are mostly enlargements of existing systems, where the demand requires immediate increased capacity.

Although eighteen months have elapsed since the signing of the federal water-power act, the developments under that act are disappointingly small. As noted in the Federal Water Power Commission's report, sixteen or more million horsepower are represented in the preliminary applications. Only about 500,000 hp., however, are represented in actual construction and by far the greater part of that is at Niagara Falls which would have gone ahead anyhow. Here again the main deterrent is no doubt the high cost of construction coupled with the high rate of money in the early part of the year. The latter condition is somewhat ameliorated but the former still seriously affects hydro-electric construction, especially that which must operate under such rigid government supervision as will the federal-grant plants.

This latter restriction is being made much of by the public-utility interests. They claim that the commission's regulations as to depreciation reserves practically prohibit development under the law. The question is confused but seems to be more a matter of possibilities than actualities, for by far the larger part of the proposed developments must submit to regulations of state boards rather than the federal commission. The powers of the federal commission, however, in this respect are vague and need court interpretation or amendment. Some other features, too, need clarification, among which is the definition of "navigable water," so that the line between state and federal power control will be clearly defined. At the same time the commission needs to be given a more definite status than is afforded by part-time work of three members of the Cabinet. It has a most important function in the government and should be equipped with a permanent and independent personnel so that its policies and acts may be fairly consistent.

Flood Protection a Pressing Problem

WITH multiplied argument the past year has reinforced the belief of those who have predicted great responsibilities for the civil engineer in flood protection. The past three months witnessed the virtual completion—for purposes of practical protection against great disasters at any rate—of the huge regional protection project worked out for the Miami Valley, in southwestern Ohio. The retarding-basin dams of the system are completed, and only finishing operations and some additional channel improvement remain. More modest in its proportions, but yet noteworthy in flood history, is the Mill Creek improvement in Erie which has recently been finished. Thus two potential sources of destruction have been put under control, out of the scores and hundreds which the country contains. Of these others, however, three streams, a thousand miles apart, sent down devasting floods over Pueblo, San Antonio and Phœnix. Two of these communities at least were well enough aware of their danger that they had previously contemplated the construction of protective works; in fact, urgent warning of coming flood damage had been given by engineers within a year or two. Here, then, we face an impressive demonstration of the urgency of the flood problem for every valley city. All three communities have moved promptly to develop plans and start construction on flood protection, and it may be expected that these works will get under way within the coming year. With these new object lessons before them, citizen as well as engineer will attain to a higher appreciation of flood-protection.

The Municipal Financing Problem

THE record-breaking billion-dollar municipal bond sales in the United States during 1921, reported with other pertinent data elsewhere in this issue, raise questions that are not discussed in that article. Chief among these is the effect of such huge issues upon municipal tax and debt limits. This must be considered in the light of the construction that was deferred by the war and must be carried out now at increased cost. The high interest rates on mounting debts and the high operating costs in the whole municipal field must press hard upon the rigid limits on taxation and debt under

which most cities work. Reduced to 1913 buying power terms, the bond sales of 1921 were the equivalent of a half-billion instead of a billion dollars. The same factor must be borne in mind in considering that the actual sales for the five years 1916-20 totaled 1,337 millions compared with the 1913 sales of 403 millions, and that 2,015 million dollars would have been required for the five years on the 1913 price base to keep pace with the sales of that year. This gives a shortage of 678 millions for the five years, with no allowance for growth in population and other conditions demanding increased bond issues.

It is easy to say that the taxpayers of the country cannot stand the combined strain of catching up and of meeting higher construction and capital charges. Before reaching any such conclusion one should consider such things as what the real increases are in per capita debt compared with per capita wealth; what portion of the bonds go for revenue producing services and how extensively both bond issues and taxes are being affected by mere shifts from private to public agencies of the numerous services incident to city life. Many other data, not now available—particularly not in comparable form—are needed before sound conclusions as to tax and bond burdens can be drawn. But the data are not likely to be forthcoming soon. Meanwhile municipal financing problems press for solution.

For the immediate future the chief hope lies in the more careful framing of municipal budgets. If this is to be of the greatest possible helpfulness, our cities and towns must go beyond a yearly budget—although such a budget properly framed would be an innovation and great advance for many cities. Far-reaching municipal programs, carefully framed by engineers, financiers and representatives of all the people and their needs, must become the rule instead of the exception. These programs should forecast their effect upon the net debt of the city and upon the tax rate. Such programs would cover three and ultimately five to ten years. They would consider expenditures in the light of relative needs and values and should schedule them for immediate, early and future incurrence, according to relative importance and the state of the public purse. The value of this is not evident to the average city councilman but needs no explanation to the engineer. There is work here for not only municipal engineers but for all public-spirited members of the profession.

The Trend of Highway Thought

ANY APPRAISAL of accomplishment in the highway field during the past year would fall far short of being a true picture if it were limited to an inventory of physical progress—the mileage of roads constructed and maintained, the volume of materials used and the sums actually spent or made available. A few years ago such an analysis would have been satisfying. Today other factors—the new thinking along research and economic lines—must have a place in any retrospect or prospect of highway activities.

The state highway engineer, especially, is revising his conception of his duties and from the problems of design and construction, important as they are, is turning to studies of traffic and to its influence on future highway development. This is particularly noticeable in the Eastern States, where the remarkable increase in the volume and tonnage of commercial vehicle traffic has placed upon the state highway departments responsibilities unknown a decade ago. The research developments, too, lie to an important extent in the domain of traffic economics, as distinguished from structural design—though obviously all highway research is activated by an economic motive.

State highway officials are now keenly aware of the paucity of information upon which to formulate economically sound road policies. The realization of the pressing need for comprehensive data on the amount and character of traffic and its influence on the road surface is reflected in the research activities of the U. S. Bureau of Public Roads and of some of the states, notably Illinois, in the stimulating and co-ordinating work of the highway research division of the National Research Council and in the unusually complete traffic census which has been made in Connecticut.

In its relation to highway transport problems, the term "research" must not be misunderstood. It is not confined within narrow laboratory limits. Its scope includes economics, including traffic studies and cost of transport; operation, including control of traffic, the planning of systems of transport and maintenance; design of roads, including subsoil studies, base courses and surface; design of vehicle, involving effect of loads, economy of operation and maintenance; and construction, comprising materials, plant design and control, and construction methods.

Involving the traffic-economics concept, also, is the active thought which highway engineers are giving to motor-vehicle legislation, with particular regard to limitations of weight, size and speed of motor trucks, and the establishment of a scale of license fees which will insure a road maintenance fund adequate for the upkeep of the system. The utter lack of uniformity in motor-vehicle laws in the 48 states was shown by a detailed survey, the results of which were published in this journal Sept. 1. Except in a few instances, license fees for motor trucks bear little relation to the destructive influence of these vehicles on the highway system. This field of motor-vehicle legislation offers profitable opportunity for study on the part of highway engineers, and one that they are not neglecting.

Highway transport economics, too, has occupied a prominent place in the programs of engineering societies. A number of traffic conferences, notably those at New Haven, Baltimore, and Ann Arbor, have been held. The American Society of Civil Engineers, at its forthcoming annual meeting, will make this a prominent feature. It was an outstanding topic at the recent annual meeting in Omaha of the American Association of State Highway Officials.

The past year, therefore, marks a real advance in highway thought. The highway engineer now realizes that he is not merely a technical specialist concerned solely with the design and maintenance of a roadway structure, but that he is in the *business* of furnishing transportation to the public at minimum cost. His job then involves not merely the provision and maintenance of the minimum possible convenience for traffic but the devising of a system that will be inviting, convenient and that, at minimum expense, will year by year expand to serve the traffic needs of the community. The engineer must take a broad view if he is to do his job satisfactorily. He must visualize the future. He must see the place of the road in the whole economic picture.

Statistics of Construction Cost and Volume

Engineering News-Record Construction Cost Index—Engineering News-Record Construction Volume Index—Spring Material Prices, 1913-21—Labor Rates for 1921—Contracts Let 1920 and 1921

Spring Prices of Construction Materials Since 1913

ENGINEERING NEWS-RECORD'S comparison of spring prices of construction materials has been published once a year since 1919 (Jan. 16, 1919; Feb. 12, 1920; Mar. 3, 1921). The accompanying larger tabulation gives prices of the principal materials in the New York market, for cement in Chicago, and on structural steel at the Pittsburgh mill as well as in New York warehouses. In January, 1919, we suggested that a reasonable price schedule might be the average spring prices from 1913 to 1918—that is, from the first pre-war year to the current date. We have since repeated the suggestion, and it is interesting to note—from the smaller tabulation—how price levels have been ever more nearly approaching this schedule.

At the beginning of 1919 the price average of the twelve materials in the smaller table was 69 per cent above the general average of spring prices of 1913 to 1918, inclusive; at the beginning of 1921, the average had fallen to 31 per cent; at present the average stands at only 2 per cent above the general average of spring prices for the nine years of 1913 to 1921.

The smaller table showing the price situation at the beginning of the several years does not include cement, lumber or brick. Cement (f.o.b. Chicago, without bags) is only 19 per cent above the general average of spring prices of cement; Southern pine is 20 per cent above in the New York market; brick, dock, is 38 per cent above.

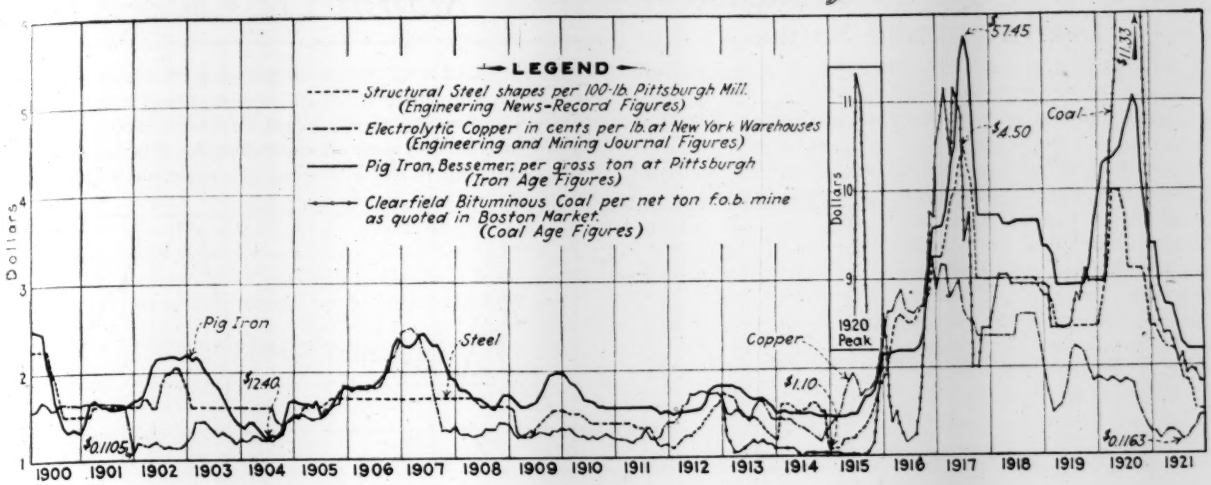
PRICE SITUATIONS IN SPRING, 1919 AND 1921
(+ indicates increase; — indicates decrease)

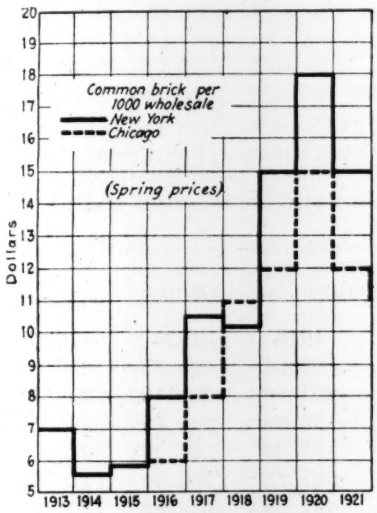
Materials	Per Cent Change, January, 1919, from General Average of Spring Prices, 1913-18	Per Cent Change, March, 1921, from General Average of Spring Prices, 1913-20	Per Cent Change, Dec. 15, 1921, from General Average of Spring Prices, 1913-21
Crushed stone, New York	+ 42	+ 61	+32
Sand, New York	+100	+ 42	+27
Gravel, New York	+120	+111	+14
Cast iron pipe, New York	+ 91	+ 45	+ 9
Structural shapes, New York	+ 52	+ 14	—18
Tank plates, New York	+ 58	+ 17	—11
Linseed oil, New York	+ 62	— 36	—27
Freight Pittsburgh to New York or Chicago on finished steel products	+ 35	+ 95	+76
Steel sheetpiling, Pittsburgh mill	+105	+ 10	—18
Structural shapes, Pittsburgh mill	+ 56	— 6	—39
Reinforcing bars, Pittsburgh mill	+ 58	+ 6	+15
Reinforcing bars, New York warehouse	+ 51	+ 11	—47
Average	+ 69	+ 31	+ 2

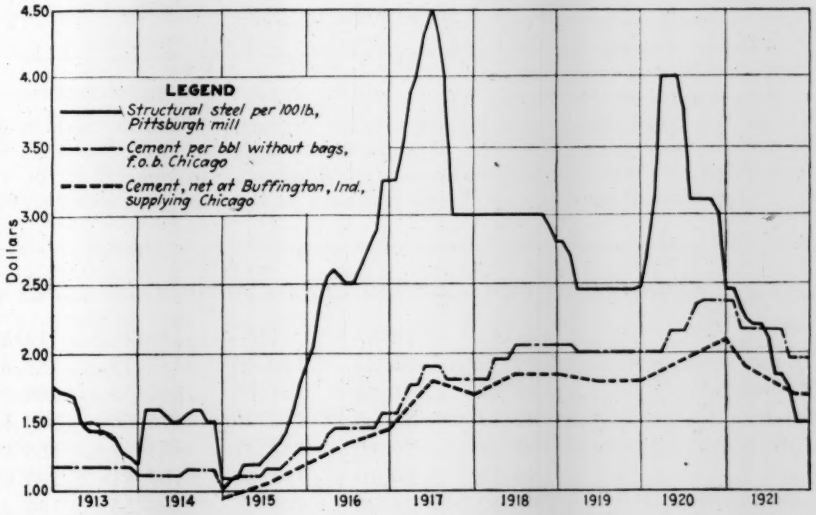
ENGINEERING NEWS-RECORD COMPARISON OF SPRING CONSTRUCTION MATERIAL PRICES SINCE 1913
All Prices New York Except Otherwise Stated

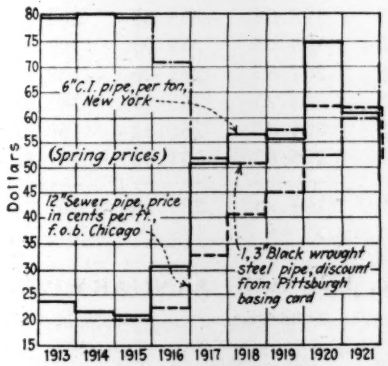
	Portland Cement, per bbl. net, with-o-t bags, Chicago	Southern Pine, 3x12 to 12x12, 20 Ft. and Under	Common Brick (per M.)	Crushed Stone (per Cu.Yd., 1 In.)	Sand (per Cu.Yd.)	Gravel (per Cu.Yd., 1-in.)	C.-I. Pipe (6 In. per Ton)	Beams and Channels (3-15-in. per 100 lb.	Beams, Etc., Pittsburgh Mill	Reinforcing Bars, 2-In. and Larger Pittsburgh Mill	Reinforcing Bars, ½-In. and Larger	Steel Sheetpiling, Pittsburgh Mill	Tank Plates ¼-in. and heavier per 100 Lb.	Hollow Tile (6x12x 12 per Block), Factory, Perth Amboy, N. J.	Linseed Oil (Raw in Barrels)	Freight to Pittsburgh on Steel (per 100 Lb.)
April, 1913	$1.19	$28.50	$7.00	$0.90	$0.50	$0.85	$24.00	$2.15	$1.70	$1.50	$2.25	$1.60	$1.61	$0.084	$0.48	$0.16
May, 1913	1.19	28.50	7.00	0.90	0.50	0.85	23.50	2.15	1.65	1.50	2.25	1.60	1.61	0.084	0.50	0.16
June, 1913	1.19	28.50	7.00	0.90	0.50	0.85	23.00	2.15	1.50	1.50	2.25	1.60	1.61	0.084	0.48	0.16
Average	$1.19	$28.50	$7.00	$0.90	$0.50	$0.85	$23.50	$2.15	$1.62	$1.50	$2.25	$1.60	$1.61	$0.084	$0.49	$0.16
April, 1914	$1.12	$28.50	$5.50	$0.95	$0.50	$0.90	$22.00	$1.95	$1.15	$1.20	$2.25	$1.60	$1.31	$0.084	$0.54	$0.16
May, 1914	1.12	30.00	5.50	0.95	0.50	0.90	22.00	1.85	1.15	1.15	2.25	1.60	1.31	0.084	0.54	0.16
June, 1914	1.12	30.00	5.60	0.95	0.50	0.90	20.50	1.85	1.10	1.15	2.25	1.60	1.31	0.084	0.53	0.16
Average	$1.12	$29.50	$5.55	$0.95	$0.50	$0.90	$21.50	$1.85	$1.13	$1.17	$2.25	$1.60	$1.31	$0.084	$0.54	$0.16
April, 1915	$1.11	$28.50	$5.50	$0.90	.....	$0.85	$20.00	$1.90	$1.15	$1.15	$1.95	$1.60	$1.36	.....	.....	$0.169
May, 1915	1.11	28.50	5.75	1.05	.....	0.85	20.50	1.90	1.20	1.15	2.00	1.50	1.32	.....	.....	0.169
June, 1915	1.15	26.50	6.00	1.05	....	0.85	22.00	1.90	1.20	1.20	2.00	1.50	1.37	.....	.....	0.169
Average	$1.12	$27.75	$5.75	$1.00	.....	$0.85	$20.75	$1.90	$1.18	$1.17	$1.97	$1.53	$1.35	.....	.....	$0.169
April, 1916	$1.42	$31.50	$8.50	$0.95	$0.40	$0.80	$30.50	$2.50	$2.50	$2.45	$3.10	$2.50	$2.50	.....	$0.81	$0.169
May, 1916	1.46	31.50	7.25	0.95	0.40	0.85	30.50	2.50	2.75	2.50	3.25	2.50	2.65	.....	0.81	0.169
June, 1916	1.46	30.50	8.00	0.95	0.50	1.00	30.50	2.60	2.75	2.50	3.10	2.50	2.75	.....	.....	0.169
Average	$1.45	$31.00	$7.90	$0.95	$0.45	$0.90	$30.50	$2.55	$2.67	$2.47	$3.15	$2.50	$2.65	.....	$0.81	$0.169
April, 1917	$1.76	$32.75	$9.50	1.20	$ 0.50	$1.25	$47.50	$3.75	$3.88	$3.35	.....	.....	$5.00	.....	$1.04	$0.169
May, 1917	1.90	34.75	11.50	1.25	0.50	1.35	55.50	3.80	4.00	3.50	.....	.....	5.50	.....	1.21	0.169
June, 1917	1.91	39.75	10.25	1.25	0.50	1.25	55.50	5.00	4.31	3.50	.....	.....	7.00	.....	1.31	0.169
Average	$1.86	$35.75	$10.40	$1.25	$0.50	$1.30	$51.70	$4.15	$4.06	$3.45	.....	.....	$5.80	.....	$1.19	$0.169
April, 1918	$1.96	$42.75	$10.25	$1.75	$1.25	$2.00	$55.35	$4.20	$3.00	$2.90	$4.09½	$3.10	$4.45	$0.14	$1.55	$0.195
May, 1918	1.96	42.75	10.00	1.75	1.25	2.00	55.35	4.20	3.00	2.90	4.09½	4.00	4.45	0.14	1.55	0.195
June, 1918	2.00	43.25	10.25	1.75	1.25	2.00	61.35	4.20	3.00	2.90	4.09½	4.00	4.45	0.14	1.58	0.195
Average	$1.97	$43.00	$10.15	$1.75	$1.25	$2.00	$57.35	$4.20	$3.00	$2.90	$4.09½	$3.70	$4.45	$0.14	$1.56	$0.195
April, 1919	$2.00	$45.00	$15.00	$1.75	$1.25	$2.00	$57.70	$3.47	$2.45	$2.35	$3.37	$2.55	$3.67	$0.159	$1.55	$0.27
May, 1919	2.00	45.00	15.00	1.75	1.25	2.00	57.70	3.47	2.45	2.35	3.37	2.55	3.67	0.153	1.63	0.27
June, 1919	2.00	46.00	15.00	1.75	1.25	2.00	52.70	3.47	2.45	2.35	3.37	2.55	3.67	0.153	1.76	0.27
Average	$2.00	$45.50	$15.00	$1.75	$1.25	$2.00	$56.03	$3.47	$2.45	$2.35	$3.37	$2.55	$3.67	$0.155	$1.65	$0.27
April, 1920	$2.00	$72.00	$18.00	$2.00	$1.25	$2.25	$72.30	$5.00	$4.00	$4.00	$5.00	$3.65	$5.00	$0.2274	$1.87	$0.27
May, 1920	2.0	70.00	18.00	2.15	1.50	2.50	76.30	5.00	4.00	4.00	5.00	3.65	5.00	0.2274	1.87	0.27
June, 1920	2.15	70.00	18.00	2.15	1.50	3.00	76.30	4.47	4.00	3.75	5.00	3.65	4.67	None	1.73	0.27
Average	$2.08	$70.50	$18.00	$2.10	$1.42	$2.58	$74.97	$4.83	$4.00	$3.92	$5.00	$3.65	$4.89	$0.2274	$1.83	$0.27
April, 1921	$2.17	$48.00	$16.00	$1.95	$1.25	$2.50	$63.30	$3.33	$2.00	$2.00	$3.28	$2.55	$2.00	.....	$0.73	$0.38
May, 1921	2.17	48.00	15.00	1.95	1.25	2.50	63.30	3.33	2.20	2.10	3.38	2.55	2.40	.....	0.67	0.38
June, 1921	2.17	43.00	14.50	1.95	1.25	2.50	58.30	3.33	2.20	2.10	3.38	2.55	2.40	$0.1156	0.80	0.38
Average	$2.17	$46.25	$15.00	$1.95	$1.25	$2.50	$61.60	$3.33	$2.15	$2.10	$3.35	$2.55	$2.25	$0.25	$0.73	$0.38
General Average	$1.66	$39.69	$10.53	$1.40	$0.79	$1.54	$44.21	$3.16	$2.47	$2.34	$2.83	$2.19	$3.11	$0.1045	$0.98	$0.216
Dec. 15, 1921	$1.97	$47.50	$14.50	$1.85	$1.00	$1.75	$48.00	$2.58	$1.50	$2.68	$1.50	$1.80	$2.78	$0.128	$0.72	$0.38

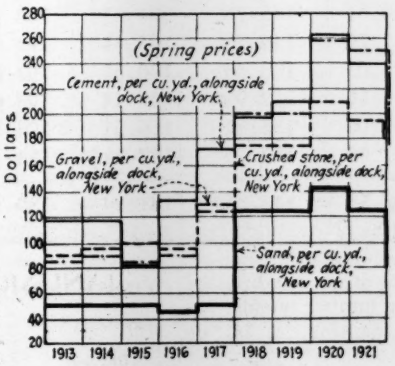
TREND OF MATERIALS PRICES

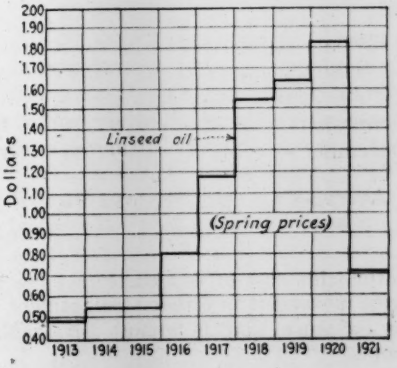

LEGEND
Structural Steel shapes per 100-lb. Pittsburgh Mill. (Engineering News-Record Figures)
Electrolytic Copper in cents per lb. at New York Warehouses (Engineering and Mining Journal Figures)
Pig Iron, Bessemer, per gross ton at Pittsburgh (Iron Age Figures)
Clearfield Bituminous Coal per net ton f.o.b. mine as quoted in Boston Market. (Coal Age Figures)
Dollars
Pig Iron
Steel
Copper
Coal
$0.1105
$12.40
$1.10
$7.45
$4.50
$11.33
$0.1163
1920 Peak
1900 1901 1902 1903 1904 1905 1906 1907 1908 1909 1910 1911 1912 1913 1914 1915 1916 1917 1918 1919 1920 1921

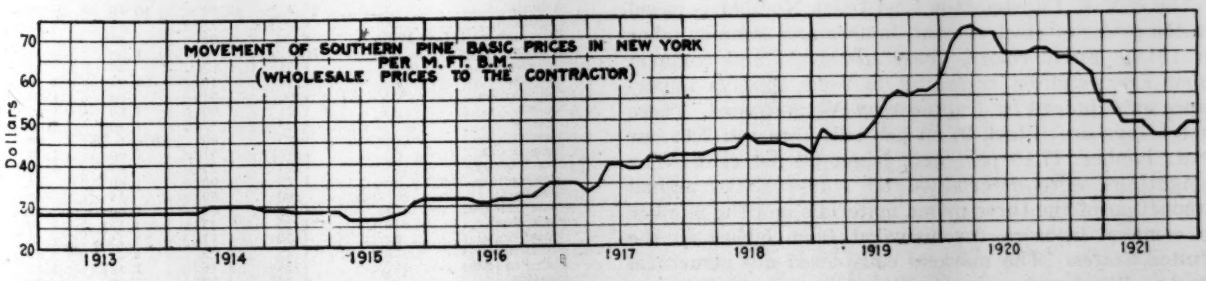



LEGEND
Structural steel per 100 lb., Pittsburgh mill
Cement per bbl without bags, f.o.b. Chicago
Cement, net at Buffington, Ind., supplying Chicago
Dollars
1913 1914 1915 1916 1917 1918 1919 1920 1921


6" C.I. pipe, per ton, New York
(Spring prices)
12" Sewer pipe, price in cents per ft., f.o.b. Chicago
1, 3" Black wrought steel pipe, discount from Pittsburgh basing card
Dollars
1913 1914 1915 1916 1917 1918 1919 1920 1921


(Spring prices)
Cement, per cu. yd., alongside dock, New York
Gravel, per cu. yd., alongside dock, New York
Crushed stone, per cu. yd., alongside dock, New York
Sand, per cu. yd., alongside dock, New York
Dollars
1913 1914 1915 1916 1917 1918 1919 1920 1921



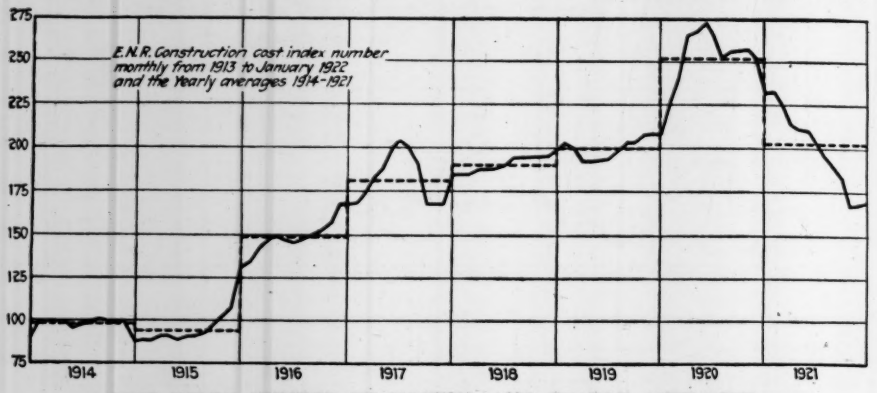

MOVEMENT OF SOUTHERN PINE BASIC PRICES IN NEW YORK PER M. FT. B.M.
(WHOLESALE PRICES TO THE CONTRACTOR)
Dollars
1913 1914 1915 1916 1917 1918 1919 1920 1921

Construction Cost Index Number—Derivation and Values

Statistics of Construction

ENGINEERING NEWS-RECORD'S Construction Cost Index Number is a national index of general construction cost in the United States. For that reason in its computation only the great basic materials and common labor are considered. Steel, cement and lumber are the fundamental materials of the construction industry, and the rate paid common labor eventually determines the cost of labor. The importance of the cost of brick, sand, gravel, crushed stone, and the rest, is not minimized; but these materials are usually produced locally and their prices are subject to fluctuating local conditions.

The *E. N.-R.* Construction Cost Index Number is not referred to Boston or Seattle, to Minneapolis or El Paso but to the 3,507,640 sq.mi. of the United States. Change in towing rates on the Hudson River will affect the price of brick or crushed stone, alongside dock, New York, without making any change whatever in the nationwide cost of construction. On the other hand, a price movement in either steel, cement or lumber wields an influence that is almost invariably continental in scope.



COST INDEX NUMBER BY MONTHS, AND YEARLY AVERAGES

The *E.N.-R.* Construction Cost Index Number is based on the prices of steel, cement, lumber and common labor in 1913. Furthermore, these materials and common labor are weighted according to their relative importance as adjudged by *Engineering News-Record*. These weightings are: Steel, 37.50 per cent; cement, 7.14 per cent; lumber, 17.10 per cent; labor, 38 per cent. The weightings were determined by studying the annual production of the three prime materials and the number of common laborers (exclusive of farm labor) in the United States. The markets considered are structural steel in Pittsburgh, cement without bags f.o.b. Chicago; 3 x 12-in. to 12 x 12-in. Southern pine to contractors in New York, and the average price of common labor in the eighteen to twenty cities listed in *Engineering News-Record* in the first issue of each month. The prices are those obtaining in the last week of each month and published in the first issue of each month. The quantities of these materials and the number of man-hours used in computing the Index Number were selected so that the total cost (quantities multiplied by prices, and added

ENGINEERING NEWS-RECORD CONSTRUCTION COST INDEX NUMBER—1914 *TO* 1921

	1914	1915	1916	1917	1918	1919	1920	1921
January	89.22	87.12	130.46	167.75	184.51	198.05	206.55	230.87
February	99.22	87.36	134.46	167.75	184.51	201.50	225.10	230.67
March	99.22	87.66	142.96	175.66	184.51	198.05	240.85	224.27
April	99.22	90.16	147.31	183.41	186.01	191.25	265.20	213.07
May	99.12	90.16	148.86	187.61	186.01	191.25	268.90	210.82
June	97.62	88.96	146.51	199.26	186.31	191.85	273.80	209.82
July	98.12	90.51	145.76	204.01	188.65	193.65	265.65	203.82
August	99.36	91.76	146.56	198.41	193.85	196.65	252.00	193.07
September	100.36	93.01	149.56	190.31	193.85	202.85	255.20	188.27
October	99.76	96.16	152.91	167.11	193.85	202.25	255.20	182.57
November	97.26	101.06	155.66	166.51	193.55	206.85	255.32	166.32
December	97.51	107.06	167.15	167.11	194.75	206.85	251.62	167.82
Averages	98.00	92.58	147.35	181.24	189.20	199.26	251.28	201.78

JANUARY, 1921, AND JANUARY, 1922,

Cities	Bricklayer — January 1921	Bricklayer — January 1922	Carpenters — January 1921	Carpenters — January 1922
Atlanta	$1.12½	$0.90	$0.80	$0.70
Baltimore	1.00	1.25	.80	.80
Birmingham (May, 1921)	1.00	1.00	.87½	.75
Boston	1@1.25	.90	1.00	.75
Cincinnati	1.25	1.12½	.90	.87½
Chicago	1.25	1.10	1.25	1.00
Cleveland	1.00	1.04	.90	1.04
Dallas	1.25	1.00	1.00	1.00
Denver	1.25	1.37½	1.16½	1.00
Detroit	1.25	1.00	.85@1.00	.80
Kansas City	1.12½	1.07½	1.00	1.00
Los Angeles	1.25	1.25	.87½	1.00
Minneapolis	1.25	1.00	1.00	.80
Montreal	.80	.80	.75	.60
New Orleans	1.00	.00	1.00	.88
New York	1.25	.25	1.12½	1.12½
Pittsburgh	1.50	1.12½	1.25	1.00
St. Louis	1.25	1.25	1.25	1.25
San Francisco	1.25	1.16	1.12½	1.03
Seattle	1.12½	1.00	1.00	.80
Philadelphia (Dec., 1921)	1.00	1.00	.90	.90

Cost and Volume

together) for 1913 would be $100 for a "unit of construction."

For example, if the quantities are 2,500 lb. of structural steel, six barrels of cement, 600 ft.b.m. of lumber, and 200 man-hours, and the prices are $1 per 100 lb. for shapes, $1.19 per net bbl. of cement, $28.50 per 1,000 ft.b.m. of lumber, and 17 cents per hour for common labor, the total computation will be $99.74; 100 is the base *E. N.-R.* Construction Cost Index Number.

The accompanying tabulation gives the *Engineering News-Record* Construction Cost Index Number for every month from 1913 to January, 1922, while the chart gives both the monthly and yearly numbers.

Construction Volume Index Number Since 1913

THE *E. N.-R.* Volume Index Number, placing present value of contracts let on a 1913 purchasing basis, was announced in the issue of Oct. 20, 1921, p. 670. Its purpose is to show actual amount of construction in pre-war terms rather than the current money value of contracts let. For example: Engineering contracts let in 1921 aggregated $1,231,370,965, against $690,539,644 in 1913. This comparison is spectacular, optimistic, but misleading, because the 1913 dollar was worth 100 cents whereas the average 1921 dollar by comparison bought only 49½ cents worth of construction.

The Volume Index Number is based on 1913—despite the fact that this was a subnormal construction year by 15 to 25 per cent—for two reasons: 1913 is the last pre-war year, and most index numbers (including the *E. N.-R.* Construction Cost Index Number) are based on 1913 prices. As a matter of fact, 1913 is normal neither as regards the volume of construction nor the monthly distribution as shown by contracts awarded. To correct the latter condition current monthly volumes are compared with the *average* monthly value of contracts let in 1913. In other words, as an example, the value of contracts in July, 1913, which was $106,011,049, is not compared with the value of contracts let in July, 1921, which was $84,791,980, but with the average monthly value in 1913, which was $57,545,000.

Letting C represent the value of contracts let in 1913 (or any fraction of 1913), C_1 the value for 1921 (or the same fraction of 1921), I the *E. N.-R.* Construction Cost Index Number for all or the considered part of 1913, and I_1 the Cost Index Number for all or the same part of 1921, the formula for computing the Volume Index Number is:

$$Vol.\ Index\ No. = \frac{\frac{C_1}{I_1}}{\frac{C}{I}} = \frac{IC_1}{I_1C}$$

But I and C are constants—100 and $57,545,000 (for and month of 1913) or 100 and $690,540,000 for the whole of 1913; therefore,

$$Monthly\ Vol.\ Index\ No. = \frac{C_1}{575{,}450I_1}$$

$$Yearly\ Vol.\ Index\ No. = \frac{C_1}{6{,}905{,}400I_1}$$

Thus computed, the Volume Numbers for the months of 1921 and for the entire year were as shown below:

ENGINEERING NEWS-RECORD CONSTRUCTION VOLUME INDEX NUMBER, 1913 TO 1921

1913 (entire year)	100
1921 (entire year)	88
1920 (entire year)	91
1921	
January	41
February	43
March	88
April	86
May	90
June	117
July	90
August	94
September	114
October	109
November	101
December	118

Trend of Labor in the United States

LABOR rates, the cost of living and the prices of construction materials all reached their peaks in 1920, and have since been declining. The labor peak, as shown by *Engineering News-Record's* monthly averages of common-labor rates in the twenty cities, was in September, when the average rate was 62½ cents per hour. The Bureau of Labor Statistics gives the cost-of-living peak as occurring in June, at 117 per cent above 1913. Construction cost also reached the peak in June, when the

RATES FOR BUILDING TRADES LABORERS IN TWENTY-ONE CITIES.

Hoisting Engineers		Hod-Carriers		Pile-Drivers		Structural Iron Workers		Common Labor			
								Union		Non-Union	
January		January		January		January		January		January	
1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922
$1.00	$1.00	$0.35	$0.30	.....	.....	$1.00	$1.00	$0.35	$0.35	$0.25	$0.20
.87½	.87½	.46@.50	.54	$0.74	$0.74	1.00	1.00	.....	.....	.30@.35	.30
.....	.....	.25@.40	.25	.....	.....	1.00	1.00	.....	.....	.20@.25	.15@.25
.90@1.00	.90	.70@.80	.60	.80@.90	.90	1.05@1.25	.90	.65@.70	.40	.....	.....
1.00	.87½	.70	.72½	1.00	.77½	1.00	.77½	.60	.37½	.....	.....
1.10	1.10	.....	.....	.....	.....	1.25	1.05	1.00	.72½	.60@.65	.35@.40
1.00	1.04	.57½	.60	.80	.91	1.00	1.04	.....	.57½	.....	.....
1.00	1.00	.60	.60	1.00	1.00	1.25	1.00	.50@1.00	.....	.40@.60	.35@.45
1.16½@1.18¾	1.00	.75@.81½	75@.81½	.....	1.00	1.15¾	1.00	.50@.56¼	.50@.55	.37½@.50	.35@.40
1.10	80@.90	.70	50@.60	1.10	1.00	1.25	.60@.80	.50@.60	.50	.....	.....
1.00	1.00	.90	.80	1.00	1.07½	1.10	1.07½	.75	.70	.....	.....
.87½	1.00	1.00	1.12½	.87½	.87½	.87½	1.00	.56¼@.62½	.50	.....	.....
1.00	.80	.75	.65	.....	.....	1.00	.80	.60	.50	.50	.50
.60	.50	.40	.30@.35	.55	.50	.50	.55	.....	.....	.35@.40	.25@.30
1.00	.90	.65	.40	1.00	.80	1.00	1.00	.....	.....	.50	.30
1.25	1.25	.87½	.87½	1.12½	1.00	1.12½	1.12½	.75@.80	.75	.....	.....
1.12½	1.00	1.00	.80	1.00	.....	1.25	1.00	.80	.....	.....	.....
1.25	1.37½	.85	.87½	1.00	1.25	1.25	1.25	.52@.60	.62½	.....	.....
1.12½	1.03	1.00	.92½	1.12½	1.03	1.12½	1.16	.81¼	.75	.50@.55	.45@.55
.87½@1.00	.90	.87	.70	1.00	1.00	1.00	.80@.90	.62½@.75	.50@.60	.50	.50
.90	.90	.75@.90	.75@.90	1.00	1.00	.90	.90	.50@.60	.50@.60	.....	.....

E. N.-R. Cost Index Number was 273.80. The large chart shows the costs of common labor and of living.

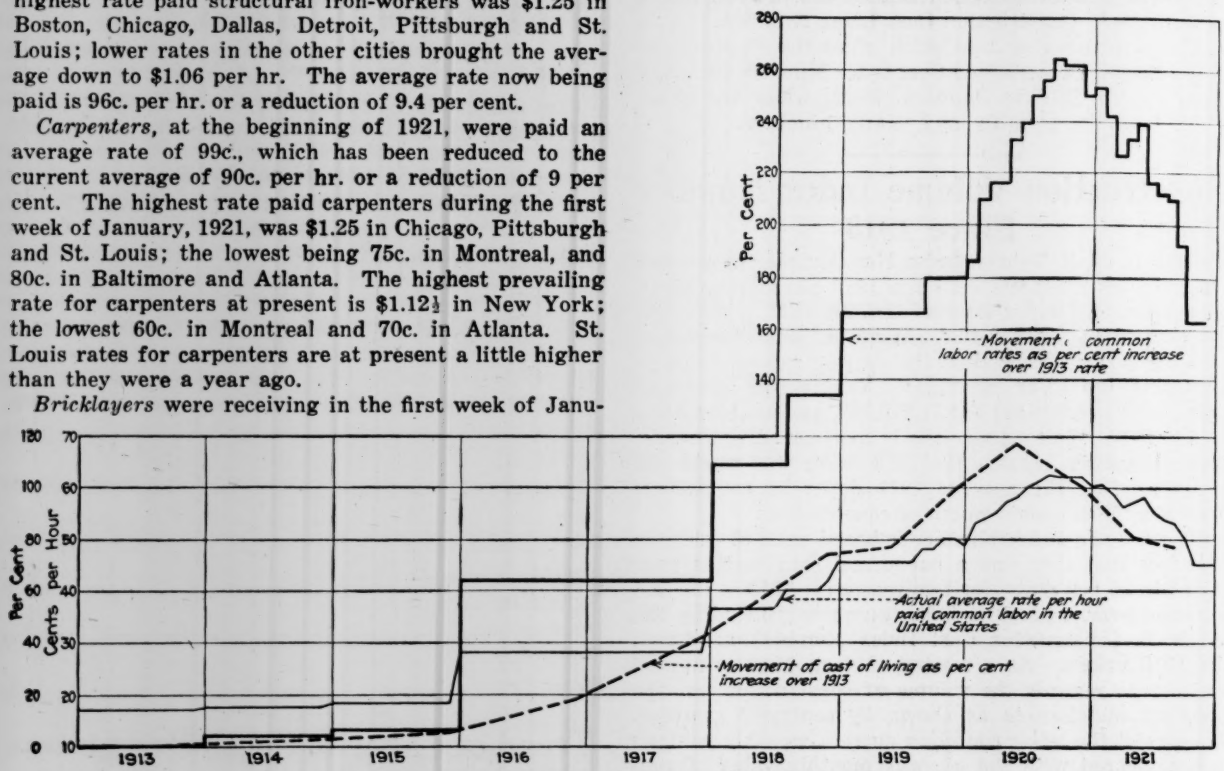
The average rates received in the skilled building trades in twenty-one important American cities during January, 1921, are here shown as compared with the current wage schedules. Of the six classes of skilled labor considered, *structural iron-workers* appear to have received the heaviest wage reductions. Throughout the twenty points in the United States and the one in Canada, during the first week of January, 1921, the highest rate paid structural iron-workers was $1.25 in Boston, Chicago, Dallas, Detroit, Pittsburgh and St. Louis; lower rates in the other cities brought the average down to $1.06 per hr. The average rate now being paid is 96c. per hr. or a reduction of 9.4 per cent.

Carpenters, at the beginning of 1921, were paid an average rate of 99c., which has been reduced to the current average of 90c. per hr. or a reduction of 9 per cent. The highest rate paid carpenters during the first week of January, 1921, was $1.25 in Chicago, Pittsburgh and St. Louis; the lowest being 75c. in Montreal, and 80c. in Baltimore and Atlanta. The highest prevailing rate for carpenters at present is $1.12½ in New York; the lowest 60c. in Montreal and 70c. in Atlanta. St. Louis rates for carpenters are at present a little higher than they were a year ago.

Bricklayers were receiving in the first week of January, 1921, an average wage of $1.16, which was reduced 6.8 per cent, making the present average rate $1.08 per hr. The highest rate paid in January, 1921, was $1.50 in Pittsburgh; the lowest 80c. in Montreal and $1 per hr. in Baltimore, Cleveland and New Orleans. The highest current rate is $1.37½ in Denver; the lowest 80c. in Montreal and 90c. in Boston and Atlanta.

Statistics of Construction

Hod-carriers are next in order of reduction with an 8.3 per cent cut in the average rate. The average in the first week of January, 1921, was 72c.; the current average 66c. per hr. The highest rate then paid was $1 in San Francisco, Pittsburgh and Los Angeles; the lowest 35c. in Atlanta. The highest current rate is $1.12½ in Los Angeles and the lowest 30c. per hr. in Atlanta.



MOVEMENT OF COMMON LABOR AND LIVING COSTS

Hoisting Engineers were cut from an average of $1.01 to 96c.—a reduction of 4.9 per cent. The highest rate for the first week of January, 1921, was $1.25 in New York and St. Louis, the lowest 60c. in Montreal and 87½c. per hr. in Seattle, Los Angeles and Baltimore. The highest prevailing rate is $1.37½ in St. Louis; the lowest 50c. in Montreal; 80c. in Minneapolis and Detroit.

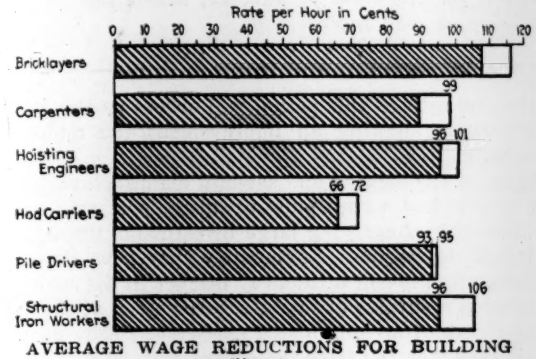
COMPARISON OF CONTRACTS LET

Classification	January	February	March	April	May	June	July	August
				1920				
Waterworks	$1,143,777	$2,171,725	$2,213,262	$2,719,021	$1,381,655	$1,460,501	$3,793,237	$775,302
Sewers	1,863,840	622,874	1,283,227	4,123,907	2,314,874	2,348,517	3,162,632	2,437,384
Bridges	2,021,553	2,137,393	2,238,661	5,586,877	5,363,709	3,185,682	3,657,615	2,172,717
Streets, roads	12,203,970	21,334,013	26,220,967	33,340,330	30,257,872	31,441,154	29,352,756	18,564,595
Excavation, dredging	1,541,576	786,943	3,151,151	415,512	403,705	604,585	1,941,897	4,179,485
Industrial	56,041,047	63,262,290	48,861,832	65,879,005	39,661,869	40,453,500	30,968,900	25,941,992
Buildings	87,095,987	52,200,466	47,541,078	90,776,835	70,946,738	31,271,042	38,947,190	33,492,290
Federal Government	4,980,945	2,282,373	1,483,605	4,124,269	1,167,045	2,625,739	4,431,976	1,687,499
Miscellaneous	8,256,071	3,466,519	15,129,378	9,602,630	14,373,320	1,319,441	13,028,267	3,410,554
Total	$175,148,766	$148,264,596	$148,123,161	$216,568,386	$165,870,787	$114,710,161	$129,284,470	$92,661,818
				1921				
Classification	January	February	March	April	May	June	July	August
Waterworks	$519,028	$2,927,307	$2,028,055	$3,342,150	$4,943,562	$3,494,584	$3,105,969	$2,404,304
Sewers	3,146,948	2,445,075	2,862,131	3,817,401	2,162,460	3,802,040	3,985,991	3,988,318
Bridges	3,030,477	885,529	1,443,060	1,987,808	1,642,894	2,417,632	5,053,520	2,353,227
Streets, roads	11,597,810	12,049,344	25,880,109	31,026,312	35,064,031	56,772,257	33,942,893	28,692,878
Excavation, dredging	1,266,346	305,740	1,625,690	580,039	2,631,799	1,240,398	609,233	89,403
Industrial	12,881,968	4,737,850	15,032,130	9,346,586	7,799,584	6,111,307	6,781,369	7,210,378
Buildings	17,455,673	31,902,608	56,520,231	51,647,900	48,442,471	56,576,768	45,452,153	50,475,001
Federal Government	2,071,141	1,574,927	3,590,617	1,186,403	1,809,588	4,158,430	3,382,964	1,355,545
Miscellaneous	2,358,976	1,728,441	4,231,823	2,732,799	4,408,142	6,005,398	3,696,957	8,075,061
Total	$54,328,367	$58,556,821	$113,213,846	$105,667,398	$108,904,531	$140,578,814	$106,011,049	$104,644,115

* Contains an item of $20,000,000, estimated value of contracts let during week ended December 29.

Cost and Volume

Pile-drivers have only been reduced 2.1 per cent or an average cut of 2c. per hr. The average wage for the first week of January, 1921, was 95c.; the current average rate is 93c. per hr. The highest rate then was $1.12½ in New York and San Francisco; the lowest 55c. in Montreal and 74c. in Baltimore. The highest current



AVERAGE WAGE REDUCTIONS FOR BUILDING TRADES LABOR

rate is $1.25 in St. Louis; the lowest 50c. in Montreal and 74c. in Baltimore.

The highest rate paid union common labor one year ago was $1 in Chicago; the lowest 35c. in Atlanta. The highest current rate is 75c. in New York and San Francisco; the lowest 35c. per hr. in Atlanta, this applies principally to the pick and shovel men in the construction industry. The highest non-union unskilled labor rate was 65c. in Chicago; the lowest 25c. in Atlanta. The highest prevailing rate is 55c. @ 56¼c. in San Francisco; the lowest 20c. per hr. in Atlanta.

Contracts Let During 1921 Total $1,231,370,965 in Value

CONSTRUCTION work throughout the United States during 1921 has been generally steady and not at all inactive as compared with 1920 if contracts let, as reported to *Engineering News-Record*, can be taken as criteria. The total value of the contracts let amounted to $1,231,370,965 in 1921 as compared to $1 582,013,036 for 1920. Such is the comparison of the contract value for the two years in actual dollars.

DURING 1920 AND 1921.

September	October	November	December	Total
$742,791	$11,168,865	$2,150,627	$1,051,335	$30,772,098
2,318,687	8,051,674	4,571,862	2,967,099	36,066,577
2,750,821	1,573,114	2,511,842	2,013,897	35,213,881
26,536,813	12,894,173	12,443,345	10,833,502	265,423,491
858,751	1,086,067	772,228	476,764	16,218,664
37,709,100	28,044,893	20,586,456	24,790,000	482,200,884
45,321,507	26,385,881	19,502,015	37,843,664	581,324,693
1,662,264	7,487,375	2,399,033	949,408	35,281,531
6,259,158	10,749,260	10,728,049	3,178,570	99,501,217
$124,159,893	$107,441,302	$75,665,457	$84,114,239	$1,582,013,036

September	October	November	December	Total
$1,487,296	$899,991	$4,698,442	$10,752,260	$40,602,948
5,063,990	2,828,974	2,733,230	2,548,484	39,385,042
3,405,876	1,144,810	1,976,449	1,989,395	27,330,677
23,256,996	20,054,543	20,750,756	16,263,498	315,351,427
9,025,229	372,871	726,328	707,424	19,180,500
13,259,789	9,441,074	11,402,944	10,251,075	114,256,054
60,979,116	62,927,041	42,859,857	43,022,433	568,261,252
3,694,113	385,960	693,751	2,703,952	26,607,391
3,301,392	6,263,410	10,793,828	6,799,447	60,395,674
$123,473,797	$104,318,674	$96,635,585	$115,037,968*	$1,231,370,965

However, during 1920 the average construction cost was much higher than that recorded for 1921. For purposes of comparison it is safe to assume this difference to be 25 per cent less in 1921. Applying then the differential in favor of 1921, the 1921 contract value is raised to practically the same as that recorded for 1920. *Engineering News-Record* has construction news reporters in every state in the country. As they report upon contracts only above specified sums, (for instance only buildings costing $150,000 and over are reported) the figures herein given do not represent the total value of all contracts let. However, *Engineering News-Record's* figures form a large enough percentage of the total values to give a close index of engineering construction conditions.

In the figures compiled and reproduced herewith no account is taken of residential construction, which, it is estimated, during 1921 comprised more than 50 per cent of the total amount of construction work.

In referring to the accompanying table several illuminating facts are apparent. In the first place, the activity in public works construction has been considerably greater during 1921 than 1920. The actual money expended or involved in contracts let for water-works and sewer construction during 1920 amounted to approximately $67,000,000. During 1921, for the same class of construction the figure was close to $80,000,000.

In the second place, there has been more street and road work contracted for during 1921 than in any previous year. The years 1919 and 1920 were considered banner years in highway construction, yet the value of contracts let during 1921 exceeded the contract value for 1910 by $50,000,000. Applying here the differential representing the decrease in cost it is seen that there was put under contract during 1921 a volume of street and road work approximately 50 per cent greater than during 1920.

So far as industrial construction is concerned, 1921 has not been a live year. However, there has been a pick-up in this class of work within the last few months and included in the class of industrial work now being put under contract are a few manufacturing plants for both the automobile and textile industries. The great bulk of the industrial work during 1921, however, has been small-factory construction and a great amount of garage building. The actual money value of contracts let for industrial construction during 1920 was over four times the amount involved in 1921 contracts.

During the last six months of 1920 there was a decided dropping off in the value of contracts from the first six months, whereas during 1921 there has been a net increase. During the last six months of 1920 the total contract value amounted to approximately $613,000,000. For the same period during 1921, the contract value attained a figure of $650,000,000—$37,000,000 higher. Also, the value of contracts let during the last six months of 1921 was almost half the value for the entire year, and this in face of the fact that the greatest amount of work is put under contract during the spring.

With the need still present for practically all classes of construction, with the prices of materials more or less stabilized, with a greater quiescence in building labor circles than existed during the early months of 1921, and with the value of contracts let showing an apparently healthy condition of the industry, there is reason to believe that 1922 will prove a more active construction year than 1921.

Interviews with Industrial Leaders

What's Ahead in 1922

Men prominent in the five leading engineering industry fields were asked by ENGINEERING NEWS-RECORD *to give their impressions of the conditions to expect in the coming year. Portland cement, steel, lumber and construction equipment are represented below. Asphalt is reserved for the issue of Jan. 12, which will specialize on road engineering.*

Lumber Industry

THE lumber industry, according to A. Fletcher Marsh, chairman of the Statistical Committee, American Wholesale Lumber Association, ended the old year in a remarkably extensive preparation for a large increase in business in 1922. In spite of great logging difficulties due particularly to excessive rains and floods, manufacturers have been exerting their utmost to fill their mill stocks to normal capacity, ready to take care of the expected rush of early buying. Every effort is being made to avoid a runaway market in 1922, by having a plentiful supply of manufactured product, even though there is a log shortage. Stocks at the mills had been greatly reduced by the long run of fall business and the year ended with the mills being pushed hard to make shipments before the holidays but apparently not anxious to take on new cutting at the prevailing basis.

As is of course known, labor both direct and indirect enters very largely into the cost of lumber to the consumer; it is still difficult to persuade the worker that he should produce concrete results for a definite wage. The South, which was hard hit by cotton deflation, has had better success than the Pacific Coast in reducing labor cost.

With the opening of the new year Mr. Marsh reports that there was a decided shortage of stocks in the local yards. The hand-to-mouth policy of buying was evident in the lumber trade just as in the other industries. The yards started to increase their buying during December, but are still needing quick shipments.

Although the railroads have done little buying of track material during the past year, from August to December they were in the market for large quantities of car material for rush delivery, causing a rapid price advance on account of deferred purchasing.

To the contractor, who by the nature of his profession must purchase for rush shipment, the foregoing is important. Usually he has had a class of lumbermen catering to his particular needs and accustomed to give his special demands rush attention to the exclusion of the slower moving routine lumber business. During the new year, it now looks as though the contractors might have to share with the railroads, the yards and the industries the demand for rush shipment, and thus have to allow their regular connections slightly longer time in which to make direct deliveries from the mill.

The past year has permitted a more thorough coordination of the lumber distributors, an elimination of the weaker ones and a better understanding of what the contractor wants in the way of service by those who cater to his requirements. Freight rate reductions from the Pacific Coast to points east of Chicago came as a welcome gift the day before Christmas and apparently on the strength of this action rail orders on the Pacific Coast began showing an improvement the middle of the month.

Many of the logging and sawmill manufacturing companies have had a hard pull during the past year due to the necessity of carrying large investments through the period of depression. Fortunately they have shown an eagerness to prevent a runaway market in the spring by developing a surplus of manufactured stock at the mills, to take care of an anticipated early and steady demand, which they look for from the contracting world.

Construction Machinery

FALL letting of contracts will help to fill up the early year seasonal valley in the contractors' equipment machinery business. Cheaper money available for municipalities will start many improvements put off because of legal restrictions. Particularly has this restriction applied to sewer and water-works as well as to municipal and state building. Labor is plentiful and amenable to more efficient methods. Stronger and heavier equipment fitted into a properly pre-arranged plan is being called for by the better contractors. In view of the above facts Philip Koehring, president, Koehring Co., Milwaukee, sees one of the largest years yet ahead of the machinery interests for 1922.

Only in industrial work will there be any pause. The railroads may not get their affairs, particularly labor, ready for large improvements and extensions until late in the season, but in practically every other line greatly increased business is to be looked for. Mr. Koehring particularly impressed the representative of the *Engineering News-Record* with the view that the more progressive contractors, large and small alike, must realize the necessity of planning work ahead, and then of purchasing proper equipment to fit the plan. In his opinion the difference between making money and losing money has been, and will continue to be, due largely to the care with which adequate preliminary plans are made for carrying out construction.

As to heavier construction machinery, he agreed that the views presented at the Omaha convention of the American Association of State Highway Officials were substantially correct. Heavier parts on machines and larger capacity, with all of the elements insured against breakdowns, were as important as to have the continuity of material and water supplies maintained. The average life of a concrete mixer, for instance, is from 4 to 5 years, so that of the 12,000 to 15,000 mixers, 20 to 25 per cent must be replaced every year. This means a certain amount of business but the manufacturers feel that more will be developed if heavier equipment be manufactured.

Structural Steel

"RECONSTRUCTION has been more complete in the field of bridge and structural-steel construction than in any other unit of the entire building industry. This statement applies to prices as well as to production efficiency. Coupled with this favorable basic condition is the fact that a very promising activity within the last three months, interrupting the marked stagnation of the early quarters of the year, promises resumption of something near normal demand. The outlook of the fabricating field for 1922 is good, on the whole, and the new year finds both the fabrication and the erection departments well prepared for best service. But don't quote me!"

Such is the opinion of leading men in the field, who are in close contact with all phases of the industry. What they have to say about the separate elements of the situation supplies a solid foundation for this general view.

From High to Low Production.—The recent history of steel fabrication must be recalled, in thinking of its present condition. With 1919 the pressure of fabrication for ship construction was over. Probably not a pound of ship work was carried over into 1920, but the heaping up of industrial orders then taxed the capacity of the shops, on to near the close of 1920. The phenomenally sharp industrial slump that set in early in that year did not at once strike the structural field, or at least was not so markedly felt, largely because of the lag of fabrication behind the general industrial demand —normally some three to six months. Orders began to drop sharply by summer; the shops felt the effect in early winter, and felt it quite suddenly. More or less steadily throughout 1920 the shops were producing in excess of 60 per cent of capacity, a high production, on the average. In 1921, however, they have been producing at rates ranging from 30 to 40 per cent of capacity, with the grand average for the year probably nearing the lower figure. The only encouraging feature about the 1921 history as a whole is the remarkable steadiness of the production, a reflection in part of the fact that demand had reached rock bottom, and in part of prompt and vigorous reconstruction measures. Finally, in the last three months a steady flow of inquiries, with a fair amount of orders, has demonstrated that the market appreciates the low level of prices. A small drop in the closing week of the year represents probably nothing more than a holiday interruption.

Labor.—Labor has reached full efficiency, it is asserted very positively. Generally speaking, this has been the case for nearly six months. Both quality of work and productivity of the men are up to the best pre-war performance. These statements apply primarily to the work in the shop, but in only lesser degree to erection. Shop production is favored by the general progress in shop equipment and methods, maintained throughout the war and partly stimulated by it. Erection still suffers from a wage rate decidedly higher in proportion than that of the shops; yet in spite of this, some remarkably low erection costs have been recorded.

Price Reconstruction.—Work has been taken at prices having little regard for cost. It is widely known that a number of large contracts for both bridge and building work have been taken within the last six months at prices almost equal to those prevailing before the war. Overhead charges have been ignored, no doubt, in offering such prices.

Average prices prevailing today are less than 50 per cent higher than the lowest pre-war prices, while the excess over normal prices prevailing before the war is very much less. This general condition will no doubt continue for a time, although prediction in this regard is hazardous. Continuing efforts are being made by the works to support their price position by reduction of overhead expense.

Financial Position.—The financial condition of the industry is thoroughly sound. The burden of losing prices has been heavy, but not fatal. There was a very material increase of capacity of the industry during the war, through the construction of new shops; yet this has not been a factor during the post-war period in the way of making competition more severe. The country's producing capacity for fabricated steel work, about 2,000,000 tons annually, is not excessive for the million and a quarter to million and a half tons annual consumption.

When these several conditions are considered in connection with the present free supply of rolled steel—practically all sizes may be obtained promptly from the mills—it is evident that the industry is prepared for most efficient service to the construction and building industries. Its business prospects for 1922 are correspondingly good. Shrewd observers, despite individual differences as to prospects of railroad activity and the like, unite in forecasting something more than a 50 per cent increase in business over that of the year just passed. The 1922 production should surpass 50 per cent of capacity, as compared with 30 to 35 per cent for the year just closing.

Portland Cement

PROPHECY, in the opinion of John R. Morron, president of the Atlas Portland Cement Co., is dangerous business. His opinions as to the prospects of the coming year as they affect the cement industry were, therefore, offered with the qualification that they were distinctly personal and, while based on the best information available to his company and himself, are subject to the possibilities of change in the unusual economic situation existing since the war. In other words, the developments of business, if it were possible to plot them in a composite curve, would follow no recognized law in the past few years, which makes it doubly difficult today to base estimates of the future on the conditions of the past.

With these qualifications, however, Mr. Morron is willing to be quoted as expecting a large volume of construction work in the coming year which, of course, means a large volume of cement used. As is well known, the cement production in 1920 was over 100,000,000 barrels, a record in the industry. Of this enormous volume, over 96,000,000 barrels were shipped from the mills. Up to the first of December, 1921, which is as far as the records now available go, the shipments were practically 99 per cent of the shipments of the similar eleven months in 1920, while the production was slightly greater than the shipments, indicating another record or near record year in cement production. The mills went over the new year probably with about the same stocks as last year; that is, between 9,000,000 and 10,000,000 barrels.

Mr. Morron thinks that the demand next year will be greater than in 1921, but he is of the opinion that this demand may not reach large figures until late in the spring or early in the summer. He expects little if any

increase in industrial building, but a pronounced increase in the already great use of cement in road work, a return to pre-war normal conditions in the railroads, and a great amount of municipal and state construction. This latter will be partly a result of such efforts as the unemployment conference at Washington to provide work by the government in times of slackness in other industries, and partly a result of the favorable financial situation in which the cities and states now find themselves due to the low interest rates which are beginning to be made available for governmental issues. Mr. Morron takes very little stock in the scarcity theory of expected production; that is, the theory commonly stated in the arguments which say that the country is short a million and a half houses and therefore we must expect that approximately that number will have to be built soon. He feels that the number of houses reported to be required is not always an accurate statement of conditions but rather an expression in part of the desire of people to live in somewhat better circumstances than they have been accustomed to or which they can afford in normal times.

Referring to the possible stocking up of the cement mills in the early months of 1922, Mr. Morron expresses the hope that the casual engineer and contractor reader of the new U. S. Geological Survey monthly statistics of cement production and stocks will read such statistics understandingly. He believes that it is a good thing for the users of cement to have some idea of the ebb and flow of cement production, but he has fears that if such figures are published broadcast there may be, on the part of a number of unthinking users of cement, the disposition to forget seasonal activities in cement use and production. For example, finding, we will say, the first of April that there is an exceedingly large stock of cement on hand in the mills the prospective cement user may argue that the mills are overstocked and that therefore the price is bound to fall, when, as a fact, this apparent overstocking is merely the provision of a far-seeing business man to have available a sufficient amount of stock to take care of expected business.

In connection with the price of cement Mr. Morron has no prediction to make. In his opinion there can be no further lowering of railway rates until there has been a proper adjustment of wages; general business is so dependent upon and interwoven with the railways that he believes it is to the welfare of all to have a proper adjustment of wages before advocating a general reduction in rates.

Labor in the cement industry has been reduced in its base rates (although still double the 1914 scale) and the men are also working more efficiently than during the war period.

While coal still costs three times what it did at the mills prior to the war, at the same time it is lower at the mines than it was a year ago, and Mr. Morron does not expect much change from these prices during the coming year.

Cement prices have been reduced, according to Mr. Morron, anticipating these reductions in labor and coal costs, and in fact he says that the prices which have been lately established by his company for cement can be maintained only when based upon the expectation of increased output and shipments.

Review and Forecast of Highway Construction, 1921-1922

Construction Cost Over $400,000,000—Maintenance Cost Nearly $200,000,000—Working Conditions Best Since the War—Outlook Favorable for Increase in 1922

ABOUT $600,000,000 were spent in highway construction and maintenance in 1921. This is $100,000,000 more than the total of any previous year. It seems reasonably certain that the expenditures for 1922 will be at least equal to and probably greater than those of 1921. All road construction activities proceeded in 1921 under far more favorable conditions of prices, wages, supply and delivery than during any previous twelve months since the war. The prospects for 1922 are even better. Maintenance expenditures in 1921 were about $180,000,000 or one-third of the total. They were about $40,000,000 greater than in 1920 and in 1922 they promise to show an equal increase over 1921. In general, 1921 was the most active year in highway improvement, ever experienced, and there is not likely to be any decrease in activity in 1922 and probably there will be an increase. With some of the year left for work to continue, when the data for this year's highway operations were assembled, and with the compilations incomplete in many states, precise mileages or amounts are impracticable. Absolute precision is, however, not needed to indicate general trend and the data assembled are amply complete for this purpose. They have been secured from state highway departments and the Bureau of Public Roads, and by visits during the year to highway operations in many states active in road-building.

Mileages and Types.—Concrete, in 1921, maintained its lead as the favored material for paved roads. Even including waterbound macadam the mileage of concrete was considerably more than half the total. Bituminous roads followed, then macadam and finally brick roads.

Certain states appear with unusual mileages of concrete construction: Pennsylvania with 612 miles, Illinois with 400 miles, New York with 367 miles and Wisconsin with 340 miles. It is more significant, however, that states only just beginning the development of paved roads, have concentrated even more closely on concrete. For example in South Carolina, Nevada, Arizona, Colorado and New Mexico, practically nothing but concrete pavement was constructed. The older road states of the east continue, as in Rhode Island, Connecticut and Massachusetts, their preference for bituminous roads, using them to replace old waterbound

In ENGINEERING NEWS-RECORD *next week, Jan. 12, 1922, there will be a dozen articles on highway design, construction, and—not the least these days—operation. Some of these will illustrate the specific points of construction and design noted in this article.*

macadam. Other eastern states divide their choice between concrete and bituminous roads. New York, notably, employed about three-quarters concrete and one-quarter bituminous construction in its road work for 1921 which is altogether a macadam reconstruction task. Oregon, in the far west, put down twice as much bituminous pavement as concrete pavement, but it is the only far western state to build much bituminous road.

Gravel roads provide the large mileage figures of the year. About one-third of the total road mileage of 1921, including graded and drained but not surfaced road, was gravel. Wisconsin and Michigan led, with about a thousand miles each, while a number of states have completed one or two hundred miles. Gravel road construction improved in general quality, a thicker and a wider surfacing was generally used. In Wisconsin, 30-ft. gravel surfacing was tested out under heavy traffic to observe its behavior.

About a quarter of the road building of the year was permanent grade construction. Many states, unable to afford high priced pavement, did a most creditable volume of work grading and draining. These were mostly middle western states, where for the moment a large mileage of serviceable highways instead of a few high quality main roads is most important.

Considering the building programs state by state, it was rare that there was any considerable distribution of the mileage between the different types of roads. Either one or the other type greatly predominated, as for example in Illinois where, with 400 miles of concrete, there were only about 3 miles of brick, 3½ miles of bituminous and no gravel road. Better balanced programs are those of Oregon and Wisconsin which are also noteworthy for their total mileage. Oregon constructed 57 miles of concrete, 130 miles of bituminous concrete, 486 miles of gravel or stone surface and 504 miles of grading. Wisconsin figures were: Concrete, 340 miles, asphalt penetration, 30 miles, macadam, 33 miles, gravel, 973 miles, miscellaneous surfaces, 229 miles and graded and drained, 1,378 miles. In addition another 504 miles of old grade were gravelled and 119 miles surfaced with other materials.

Conditions and Methods.—All conditions which affect highway construction were more favorable in 1921 than during any year since the war. Labor was plentiful and wages lower; the supply of materials was adequate and their prices were lower; transportation was adequate and deliveries prompt, and the season was one of the finest for construction operations experienced in many years. These conditions were nearly universal.

Transportation rates were the greatest obstacle to construction. In many states, where aggregates for concrete have to be imported by railway, the increase in freight rates has offset to a large extent the decrease in the prices of materials.

Bidding prices reflected the more favorable construction conditions; they decreased 10 to 50 per cent compared with 1920. As examples of the general reduction there are cited the following figures from widely separated states: New Mexico 40 per cent, Nevada 20 per cent, Colorado 20 per cent, Vermont 20 to 30 per cent, Connecticut 40 per cent, Delaware 10 to 15 per cent and Alabama 25 to 50 per cent. Contractors have been plentiful and competition in bidding has been active. In frequent instances the bids have run well below the engineers' estimates.

Construction methods were not generally altered. A great many states prohibited, by specifications, stockpiling on the subgrade and this eliminated methods and equipment designed specifically for continuous or closely spaced stock piles. The swing was toward central proportioning with dry batch haulage by trucks or industrial railway, and in truck haulage practice inclined toward large trucks carrying three or four batches in partitioned bodies instead of single batch small trucks, but the shift was not marked. The industrial railways hauling of cars carrying batch boxes increased in popularity. There were more central mixing plants than in previous years but the practice made very little gain geographically. Paving mixer and finishing machine practice remained about the same. There was an inclination to demand heavier and more sturdy equipment, but almost no progress was made in standardizing equipment.

In general methods, the most suggestive development of the year was working double shifts. A number of contractors in Illinois adopted this practice with highly satisfactory results. One of them, with a four-bag paver, working double shifts for about half of the season, constructed 16 miles of 16-ft. pavement. This is probably the record mileage for an outfit of this size.

Forecast for 1922.—With the greatest year of highway construction just concluded it is also possible to prophecy with some confidence that a greater year is to follow. With reports from 75 per cent of the state highway departments, including all the principal road building states, the summary is as follows: 50 per cent estimate increased expenditures for 1922, 30 per cent estimate an expenditure equal to that of 1921, and 20 per cent estimate a slight curtailment in expenditure due generally to the smaller Federal aid appropriations available. One state, Illinois, which spent $17,838,000 in construction in 1921 expects in 1922 to spend $35,000,000 in paving, grading and bridges. This is perhaps the greatest percentage of increase which any state hitherto active in road building contemplates, but a number of the larger road building states estimate increases of 10 to 20 per cent.

It is important to note that the estimates are in money to be expended. With the reduction in costs which has come about, from 10 to 30 per cent, the same expenditure in 1922 as in 1921 means a considerably greater mileage of highways improved. By all counts 1922 promises to be a banner year in highway construction.

Road Widening and Resurfacing in California

The California Highway Commission recently awarded to the Southwest Paving Co., of Los Angeles, a contract for 8.41 miles of widening and surface between Naples and Gaviopa Creek in Santa Barbara County. The main features of this work involve new reinforced concrete shoulders, 2½ ft. wide by 7 in. thick, laid on each side of the old slab. The surface of the new shoulders is from 2½ to 3 in. above the existing pavement and the trough thus formed is to be filled with asphaltic concrete from 2½ to 3 in. thick. The contract price was $92,884 and material to be furnished by the state amounts to $110,877.

The engineer's estimate of the cost of the work was $116,204.

Municipal Bond Sales in 1921 Top All Previous Records

More Than a Billion Dollars Worth Sold But Construction Cost Index Halves Buying Power—Year Closes With Heavy Sales, Falling Interest Rate and Improved Construction Outlook

MUNICIPAL bond sales in 1921 passed the billion-dollar mark. The total exceeded by a half billion the highest previous record. The low war level of 1918 was exceeded by something like a billion and the figure for the immediate pre-war year, or 1913, was multiplied by more than four. These approximations are market totals. They take no account of relative buying powers, which will be shown later when figures based on the *Engineering News-Record* construction-cost index are presented. But even after being reduced to the common denominator of 1913 prices, the 1921 bond sales were far in excess of those for any year later than 1915, and well over those for that year. The 1921 sales, reduced to the 1913 buying power basis, are perhaps 50 per cent above those for 1913, exact comparisons being as yet impossible.

High interest rates characterized the bond issues of 1921, but with a notable decline as the absorptive power of the market rapidly increased at the close of the year. Gilt-edge and certain much-sought-for bonds sold in December at say one per cent lower than in the previous year or, in some cases, than they did well into 1921; but notwithstanding this the prevailing rate for the entire year, taking all issues into account and ignoring volume, was probably 6 per cent or more. This contrasts with a prevailing rate of less than 4 per cent twenty years ago, based, in this case, on both volume of sales and number of issues. The much lower rate at the very close of the year and the very active demand for municipal bonds promised well for 1922

Heavy Bond Sales in Last Quarter of Year

During the last quarter of 1921 bond sales exceeded 400 millions, or more than the total for the entire year of either 1909 or 1910. Thus the *Commercial and Financial Chronicle*, from which most of the basic data in this article are taken, gives the October sales as nearly 114 million and the November as almost 118 million. November high records in the previous ten years were: 57 millions in 1920; 48 in 1919 and 31 in 1913. The *Chronicle* totals for December are not available as this is written, but for the first 11 months of 1921 its totals were 990 million. The *Daily Bond Buyer* gives the 11 months' total as 1,100 million, the December total as 206 millions and the total for 1921 as 1,306 millions. The *Bond Buyer's* figures for 1920 and 1919 also exceeded those of the *Chronicle*. Presumably, the *Chronicle* total for 1921 will be 1,200 million or more.

Prior to the record-breaking total of more than a billion dollars of municipal bonds sold in the United States the record was $691,500,000 in 1919, but 1920 fell behind only $8,300,000, as shown by Table I. By far the lowest year for a long period was 1918, when the total was only $296,500,000. These totals include only permanent additions to the bonded indebtedness of the states, counties, cities, and other minor civil divisions of the country. The totals have been swelled in recent years by state bonds issued for many purposes, notably highway bonds.

It was not until 1913 that municipal bond sales passed the $400,000,000 mark, although they were near that figure in both 1911 and 1912. The advance was rapid in 1914 and in 1915. There was a considerable fall the next two years and a great slump in 1918.

Applying the *Engineering News-Record* construction-cost index—based on 1913 costs of common labor, structural steel, cement and lumber prices—bond issues from 1914 to date take on a much different relationship, year by year. On this basis, a hundred dollars of bonds would buy slightly more material and labor in the United States in both 1914 and 1915 than in 1913, and from 1916 to the present time much less, 1920 having an index or divisor of 251 and 1921 of 202, the latter being slightly above 1919 and higher than for any year but 1920 since 1913. The index by years and the corresponding buying power of bonds sold are shown in Table I.

TABLE I. YEARLY MUNICIPAL BOND SALES IN THE UNITED STATES, BUYING POWER OF PROCEEDS SINCE 1913 AND PREVAILING INTEREST RATES

The total bond sales and the interest rates pri r to 1921 are from the *Commercial and Financial Chronicle*; the 1921 figures are estimated. The totals are given in millions of dollars.

Year	Total Bond Issues	Construction-News Cost Index	Buying Power 1913 Basis	Prevailing Interest Rate — Rate Per Cent	Prevailing Interest Rate — Amount*	Prevailing Interest Rate — Per Cent of Total*
1921	1,200+	202	600+	...	.....	.....
1920	683.2	251	272.2	5+	332.7	49.15
1919	691.5	199	347.5	5	278.3	40.71
1918	296.5	189	156.9	...	.....	.....
1917	451.3	181	249.3	...	.....	.....
1916	457.1	147	310.9	...	.....	.....
1915	498.6	93	536.1	...	.....	.....
1914	474.1	98	483.8	...	.....	.....
1913	403.2	100	403.2	...	.....	.....
1906	190.0	...	.....	4	120.1	63.22
1901	140.2	...	.....	3½	68.7	49.00

* The figures in these two columns are computed on the various yearly totals less purchases for New York City sinking fund. By "prevailing rate" is here meant the rate which shows the largest percentage of total bond sales.

The buying power of bond proceeds fell from the corrected total of 536 million dollars in 1915 to 157 millions in 1918, notwithstanding respective bond sales of approximately 500 and 300 millions. Similarly, the nearly 700 millions of bond sales of 1919 had a purchasing power of only some 350 millions. The rise of the construction-cost index to 251 in 1920 cut the real value of the again almost 700 million bonds to less than 275 millions. The fall in the index of 1921 to 202 is a material aid to purchasing power but cuts the real value of the immense total of more than a billion of bond sales to less than half, so that notwithstanding this unprecedented addition to the municipal bond burden of the country, it gives little more purchasing power than did the half billion actual bond sale of 1915, with its 536 billion purchasing power, but for 1921 to be actually in advance of 1915 is a reason for congratulation. Should one go further and apply corrections for (1) increase in population and (2) vast increase in construction needs due to accumulations of deferred construction there would be a heavy further shrinkage and a marked increase in the gap between construction needs and purchasing power of the bonds sold in 1921,

True, the story cannot be fully told even by reducing the bond sale proceeds to a pre-war buying-power basis, for even then no distinction is made between bonds issued for new construction and those put out to fund floating debt incurred for work already completed or

to refund bonds falling due. As to the latter, the *Chronicle* figures show that from 1920 as far back as 1917 the first of these ran 1.67, 1.93, 3.27 and 3.40 per cent of the gross sales, while under the combined classification "funding and improvement" corresponding percentages were 7.37, 6.98, 8.36 and 4.94. It seems safe to say that the combined funding and refunding bonds of 1921 would not exceed 10 per cent of the total. If a deduction of such a percentage were to be made for 1921, so should it be for other years, so the relative standing for the various years might not be much changed. The $55,000,000 refunding bonds sold by New York City in December, 1921, to refund "corporate stock" issued for rapid transit purposes from July, 1917, on was presumably quite abnormal but illustrates what may happen.

TABLE II. NEW YORK *TIMES* REPORTS OF MUNICIPAL BOND SALES IN DECEMBER, 1921

Rate Per Cent	For the Week Ended Dec. 9 No.	Dec. 9 Amount	Dec. 16 No.	Dec. 16 Amount	Dec. 23 No.	Dec. 23 Amount	For the 3 Weeks Ended Dec. 23 No.	For the 3 Weeks Ended Dec. 23 Amount
6½	..	.....	..	.....	1	$92,000	1	$92,060
6	7	$2,511,000	8	$3,817,000	6	6,136,000	21	12,464,000
5½	2	435,000	4	5,563,000	4	1,227,000	10	7,225,000
5¼	..	.....	1	1,200,000	..	.....	1	1,200,000
5	4	4,347,000	6	6,100,500	16	7,594,000	26	18,041,500
4½	..	.....	1	1,500,000	..	.....	1	1,500,000
4¼	4	8,891,000	5	63,796,000	1	200,000	10	72,887,000
4	2	1,600,000	..	.....	..	.....	2	1,600,000
3½	..	.....	..	.....	1	250,000	1	250,000
Totals	19	$17,784,000	25	$81,976,500	29	$15,499,000	73	$115,259,500

To the retarding effect on bond issues of the high cost of construction work or low buying power there has been added a high interest rate, which, besides discouraging bond issues, has in many cases barred them because of the statutory fixing of the rate of interest or the prohibition of the sale of bonds below par. Although these drags combined—low purchasing power and high interest rate—were not sufficient to keep the total municipal bond sales from reaching an unprecedented figure, they unquestionably held back the total sales materially. Proof of this is afforded by the marked rise in sales at the close of the year, accompanying the decline of interest rates and the increasing frequency of high premiums, with the consequent equivalent further reduction in the cost of loans when yields are figured.

Using again the *Chronicle* figures (Table I) we see that while in 1901 almost half of the total bonds sold bore only 3½ per cent interest and while in 1906 about 63 per cent of the sales were 4 per cent bonds, in 1919 some 41 per cent of the bonds were at 5 per cent and in 1920 about 49 per cent were in excess of the 5 per cent rate. Unfortunately, the *Chronicle's* summary does not show how much the 5 per cent rate was exceeded in 1920 and the prevailing rate for 1921 (i.e., the rate at which the largest percentage of all the bond issues were sold) has not yet been announced.

Some light on the prevailing rate towards the very close of the year is thrown by sales of 73 leading issues totaling $115,300,000 reported by the New York *Times* for the three weeks ended Dec. 23 (see Table II). The prevailing rate—again by volume—was 4½ per cent for some $73,000,000, or about half of the total sales in this list; but this included a single issue of $55,000,000 sold at 4½ per cent by New York City. The sales in excess of 5 per cent or more in this list were only some 18 per cent of the total, in marked contrast with the 49 per cent for the whole year 1920. Presumably, complete reports for the three weeks in question would show less of a decline, but that there was a marked decline in the latter part of the year seems certain.

Further testimony as to this decline is afforded by comparing (what is in some respects preferable from the viewpoint of cities of all classes) the number of issues rather than the volume of sales at various rates of interest. For this purpose Table III has been compiled, taking the *Chronicle* sales for October and November, 1921, and the *Times* sales for the three (nearly) following weeks. Besides interest rates, Table III shows yield rates for the corresponding bond sales. Both the main part of Table III and the summary at its foot bear convincing testimony of the declining interest and yield rates in November and December. The yield rates reflect more strikingly than do the interest rates the relief from high cost of bond proceeds at the close of 1921. The $55,000,000 New York City 4½ per cent bonds were sold on Dec. 15 at 103.407, yielding 4.25, and the total subscriptions were almost six times the amount offered.

The recent trend of events in the municipal bond market, combined with the accumulation of deferred municipal construction, is towards continued high total sales of municipal bonds in 1922. Although the improvement in the market for municipal bonds late in 1921 was in part due to year-end investment shifts and to the accumulation of investment funds during a period of quietness in utility and industrial bonds it does not seem likely that changes in these conditions will be sufficient to force the bond sales of 1922 below the 1921 total and stop the downward trend of interest rates. However, it is to be noted that as the municipal bond interest rate falls there will be those among the more venturesome who will seek higher yields on their money. This, and a general business improvement, would divert some of the capital that would otherwise go into municipal bonds and tend to raise the interest rate and discourage city and state bond issues. But with so much work waiting to be done there is strong reason to expect large flotations of municipal bonds in 1922 and with them an increase in construction work. The increase in volume of work will be all the more notable if the construction-cost index continues to fall.

TABLE III. BOND RATE INTEREST AND YIELD RATES IN THE UNITED STATES FOR THE LAST QUARTER OF 1921

October and November figures compiled from the *Commercial and Financial Chronicle*; December figures from New York *Times*

Interest Rate Per Cent	Number of Cities at Each Interest Rate: October	November	Three Weeks Ending Dec. 23	Yield Range Per Cent	Number of Cities at Each Yield Rate: November	Three Weeks Ending Dec. 23	Week Ending Dec. 23
8	4	3	..	8	1	..	..
7	5	14	..	7–7.99	3	..	..
6½	4	3	1	.....	...	..	..
6	273	278	21	6–6.99	68	7	2
5½	1	2	..	.....	...	..	..
5¼	57	55	10	.....	...	..	..
5½	12	10	1	.....	...	..	..
5	54	72	26	5–5.99	121	19	5
4½	1	5	1	.....	...	..	..
4¼	4	7	10	.....	...	..	..
4½	...	1	..	.....	...	..	..
4	4	3	2	4–4.99	43	46	22
3½	...	...	1	.....	...	..	..
	419	453	73		236	72	29

NUMBER AND PER CENT OF ISSUES AT 6 OR MORE AND AT 5 OR MORE PER CENT

	No.	Per Cent	No.	Per Cent	No.	Per Cent		No.	Per Cent	No.	Per Cent	No.	Per Cent
6 or more	286	68	298	66	22	30		72	30	7	10	2	7
5 or more	410	97	437	96	59	82		93	82	26	36	7	24

Concrete—Past and Future

What the Past Twenty-Five Years Have Taught Us and What We Must Learn If It Is To Continue To Grow in Use

Editorial Review

IT IS now about twenty-five years since reinforced concrete came to the attention of the American engineer. For a dozen or so years before that it had been used extensively by a few specialists in France and Austria, and their patented structures, mainly bridges, were the first evidences of the new material over here. Mass or plain concrete was used, of course, but the cement production and importation figures show how limited was even this use. In 1896, for instance, 9,000,000 barrels were produced and about 2,000,000 barrels imported, and of the amount made in this country only 1,500,000 barrels were portland cement. In other words, assuming all the importations to have been portland cement, the consumption of portland cement in this country twenty-five years ago was one-thirtieth what it was the past year. The total hydraulic cement consumption was probably about one-tenth of that today.

Once reinforced concrete was introduced, however, the spread of its use became phenomenal, and with it came a wider appreciation of the virtues of plain concrete. Production in 1900 had grown to over 17,000,000 barrels, in 1910 to 78,000,000, and in 1920 to over 102,000,000, practically all portland cement. Just how much of this went into plain and how much into reinforced concrete nobody knows nor is it very important now to distinguish between the two. The important thing is that the recognition of the structural capabilities of concrete reinforced with steel opened up a new era in engineering design and construction. Today a knowledge of concrete must be a part of the equipment of every civil engineer and contractor because it enters into very kind of construction. Other subjects are left to specialists, but concrete is universal.

What is Needed Now

This universality has its vices as well as its virtues. So many people are interested in perfecting concrete that more study is probably being given to it than to any other one engineering subject. More interest is displayed at a technical meeting when concrete is discussed. Wider attention is given to technical papers on it. On the other hand, so many men, both ignorant and informed, are putting in concrete that there has grown up the familiarity which breeds contempt, a disdain for further inquiry into its composition and manufacture and a complacence regarding its behavior. These two divergent attitudes need to be brought together. The work of the student must be popularized, the man at the mixer and at the forms must be educated out of his ignorance and complacency. Just now, when the latest report of the Joint Committee on Concrete and Reinforced Concrete is receiving so much attention, seems to be a favorable time to set down some of the things we have learned about concrete, and to inquire into the progress we have made, with a view to orienting ourselves for future progress.

In these past twenty-five years, roughly 1,500,000,000 barrels of cement have been used in the United States, which, again roughly, converted into cost of concrete made from it reaches the almost incredible sum of $15,000,000,000. What is the present condition of this concrete which cost half as much as the World War cost the United States and which is supposed to be long-lived, if not eternal?

In the first place, most of it—certainly a large part of it—was put in under no engineering supervision whatsoever. The cement was bought bag by bag from the local dealer and is a part of floors, backyard steps, house foundations, drains, fences, and a hundred other little details which the farmer, mason, or city householder builds for his own convenience. Considering the lack of information such builders have regarding the necessities of concrete design and construction, these concretes in minor structures are in good condition. They could be made much better by a closer adherence to better practice but their failure, when failure occurs, is generally of negligible importance.

Building Concrete is Good

Another large proportion of the cement production has gone into buildings, and here, too, the results have been satisfactory in the main. It is rare that one sees the interior of a concrete building in any condition of deterioration. Where failure has occurred it is almost without exception either in the structure during erection or a failure in design due to obvious overloading or a misapplication of the accepted principles of structures. Such concrete may not be as economical as it will sometime be made but it is safe and so far as we can now tell permanent.

The remaining important application of concrete has been to exterior structures. Here the story is not so pleasant. There is no use blinking the fact that concrete as commonly placed in the last twenty-five years is not a permanent material when exposed to the weather. Everyone who travels through the country knows that much outdoor concrete is in various stages of disintegration. Occasionally one comes across concrete masonry in as good condition as a contemporary limestone or granite masonry. This, however, is the exception. Scaling, spalling, cracking, the latter where steel is near the surface, are the common exhibits in bridges, building faces, piers, abutments, which have passed beyond the eight or ten years which seems to be the critical age of outdoor concrete. This does not mean that such structures are at the point of failure. Far from it. In many of them the surface disintegration means nothing more than that that surface has been unable to resist the attack of moisture. The main difficulties are in appearance and not in structural integrity, though here and there there are instances of so near an approach to structural failure as to cause worry. More and more of such cases are being brought to light in technical papers and proceedings, but many more have never been made public because of reticence on the part of their builders and fear of depreciation of concrete as a building material.

What is causing the deterioration of these structures? Quite obviously, the attack of the elements, mainly water, on the cementing element. The stone ingredients can resist such attack but the glue which joins them together cannot always do so. The trouble lies in the porosity, sometimes microscopic, which permits the penetration of the water throughout the mass. When steel is near the surface—just how near it can safely be is still a matter of debate—we get the rusting and most familiar form of final failure.

Outdoor Concrete Must Be Better

The engineering profession must recognize the necessity for a bettering of conditions in the production of outdoor concrete. Some appreciation must be had of the distinction between a concrete always protected from great variations of temperature and moisture and one which is outdoors subject to a change of temperature of 100 or more degrees and of alternate wetting and drying throughout a long period. The fact is that the criterion of indoor concrete is strength, whereas the criteria of outdoor concrete are both strength and density. Current methods of concrete production, even as practiced by the average engineer and contractor, can insure a sufficient strength; they do not always insure sufficient density. There is some relation between the two properties of concrete, but it well may be that the concrete which reaches a strength now thought sufficient for structural purposes is not dense enough to resist for a long time the inroads of the weather.

Density, as such, is not sought in concrete today. Strength is the measure by which quality is judged. Moreover, there is no good measure of density whereby one can judge the capability of a concrete to resist moisture and temperature attack, except the measure of strength, which itself is determined by the not too well related measure of test-piece behavior.

In considering what the future progress of the art may be it will be well to take our bearings on our present knowledge. Look at the constituents first. Cement used to be the favored point of attack in any investigation of inferior concrete. It is no longer so. Portland cement has been standardized in a specification accepted by the government and the leading technical societies, and rarely is there any divergence from it in any individual specification. To achieve such a standard specification has long been the ambition of the cement manufacturers and of most of the cement users. Certainly, it is a great step ahead of the many varying specifications which were common twenty years ago. It must not be forgotten, however, that this accepted standard specification is deadening in a certain way. Cement is standardized so that the user may be guaranteed a superiority to a certain definite minimum of requirement, but he is not guaranteed any uniformity above that minimum. It is a well-known fact that cements, all of which pass the standard specification, are of great variation in their different qualities, particularly in strength, so that while use of any accepted cement may assure a certain strength, there is no assurance that a stronger concrete could not have been obtained by some other equally acceptable cement which gave higher test values.

There is no question, too, of a general feeling among engineers that the cement makers themselves are satisfied with the present situation and that they are more anxious to preserve the standard specification than to get a better product. This is partly true. To improve a product in any way, such as, for instance, by the increased fineness talked of some years ago, would require a large revision of the manufacturing machinery and a great expense with a doubtful improvement in quality. So long as there is no overwhelming evidence that the present product is causing difficulty, the manufacturers will prefer to continue working under the present specification, and to this extent progress is hampered. It is unfortunate, too, that practically all the cement experts are confined to the cement trade. Very few engineers know anything about the manufacture or the chemistry of cement or have sufficient knowledge to make any reasonable recommendation as to the improvement of cement quality. Outside of the manufacturers' employees there are a few experts in the employ of the government and one or two independent consultants, who must look for most of their business from the cement manufacturers themselves. The manufacturers continue to study their material, of course, but they are naturally conservative and little disposed to advocate any changes unless those changes promise wider use or lower cost of the cement

Not Much Hope for Better Cement

It results, therefore, that the only place where we can hope to look for any radical recommendations regarding the cement itself is from the government engineers who are limited in number and who, therefore, must work slowly. There is no doubt that so long as there is no good measure of superiority in cement nor any bonus for a superior product portland cement will continue to be the same product as it is today and that there need not be any great improvement in it looked for. The portland cement of today is a remarkably good material. The point is that no one knows and there is not much chance of engineers finding out whether it is possible to produce a better material.

A few years ago many engineers thought that practically all had been learned about steel, the material, but the later crystalographic studies have since opened up entirely new possibilities in the material. By the same token, it will not do to assume that we have achieved the perfect portland cement.

Regarding the aggregate, the other ingredient of concrete, we have learned a great deal in the past five years mainly in regard to its proportioning, but a calm survey of this new learning leads one to the conclusion that it is merely the bringing to wide attention of the facts developed a good many years ago. As far back as the seventies, Feret, the French investigator, laid down a good many rules for the manufacture of concrete, which are announced every once in a while today as new matter. It is nearly fifteen years ago that the Fuller and Thompson paper on proportioning appeared in the American Society of Civil Engineers; ten years ago Chapman proposed slump tests and proportioning for strength in the American Society for Testing Materials. The later developments of the void theory, of surface-area measurement and of fineness-modulus investigations are all groping steps toward some final method of proportioning and specifying aggregate which has not yet been reached. The goal of all these methods is to establish some method whereby available aggregate can be graded and mixed so that there will be the most

compact grouping of the various particles that go to make up the concrete.

The quantitative effect of the water in concrete, as investigated by Prof. D. A. Abrams, has been a definite step forward in proportioning. While there is still much doubt as to the wide applicability of his theory to the proportioning of specific mixtures, there is no doubt that the part water plays in the concrete mixture is now much better appreciated and that the average concrete now being made is measurably better since the theory and the experiments in which it was based were made public.

In the production of the concrete itself we are going ahead slowly. Mixing and placing machinery is better mechanically than it was ten, fifteen, or twenty years ago, but in its general principle this has changed but little. Let any engineer cast his memory back twenty years to the concrete machinery used then and he will see that the manufacturers have done a great deal toward making the mixing and placing of concrete a more economical and simpler process, but very little toward making the concrete a better product. There is room for inventive thought in this field.

Design Reform Unimportant

Little has been said in this review about design. This is intentional. In spite of the controversies that can be developed at a moment's notice regarding features of design of reinforced concrete, structures resulting from the standard methods now generally accepted will be but little changed by any proposed new method. It is true that the radical innovation of accounting for concrete plasticity in column design, as advocated in the latest specification of the Joint Committee, will materially affect the design of columns and may in some places cause some serious competition with other types of structure. It is true that the exact placing and proportioning of shear members have a certain definite effect on the total cost of an individual building. Variations in flat-slab designing make a considerable difference in the flat-slab structures of Chicago and New York. Unit stresses seem to grow higher with each new specification. But, after all, these are minor questions in the development of the art of concrete. With the systems of designing which have been accepted in the past the structures standing today are safe and apparently permanent. After all, the design of reinforced concrete is not precise; the material itself is highly variable in strength, the fundamental principle of the co-ordinate action of the steel and concrete is only an approximation, and certainly not well established. If the material itself does not come up to the anticipated unit strength or in a relatively short time seems to deteriorate in strength all the refinements of design are useless.

Every step forward in design promotes either economy or safety in succeeding structures; it does not depreciate the safety nor can it have much effect on the economy of existing structures. Once erected and in some term of acceptable service, with the rare exceptions of progressive deflection under load, the matter of the design of a structure is of no concern. The condition of the material itself is quite different, for that is an ever-present source of trouble. If concrete made today is to have entirely different appearance and qualities ten years from now a serious problem is presented to the designer. If concrete supposed to have a compressive strength of 2,000 lb. and an impervious texture turns out of the forms worth only 1,500 lb. and full of holes, the question whether 0.08 or 0.12 should have been used as a shear coefficient is largely academic.

It is manifest that the progress of the future must come mostly from construction improvements—improvements that will guarantee that every bit of concrete will be what the design assumes it to be, a dense artificial stone of predetermined strength. We must, therefore, be able to insure a dense concrete. How can we do it? There is no single rule which followed will lead on to success. In our present state of knowledge we can only insist on observance of all the little rules which time has developed and these little rules are so numerous that they might be recorded, for example, by listing the side-heads in the Joint Committee specification.

But their fundamentals may be covered possibly by two phrases—more mechanical control, better education of the man on the job.

While what may be called the scientific aspects of concrete are by no means to the stage we hope they will arrive, they are certainly sufficiently advanced to guarantee, if observed in practice, a much better concrete than we now ever get. The cement itself, the choice and grading of the aggregate, the proportioning of the ingredients including the water are all governed by scientific knowledge which, while not perhaps much greater than twenty years ago, is certainly more widely distributed. The practical manufacture of the concrete, on the other hand, remains for the most part in unintelligent, though not necessarily unskilled, hands. Worse than that, it remains in the control of that most dangerous of individuals, the ignorant person who thinks he knows. In spite of all the literature and propaganda advocating proper concreting methods, the man next to the mixer and the forms remains today in practically the same state of information regarding the product as his predecessor was in a quarter century ago.

Mechanical Control Necessary

We must, therefore, do everything we can to take away from him any of the control of the concrete. To some extent this has been done by batch-meters, mixer locks, water-control valves, and other attachments. Much more can be done in the way of mechanical proportioners such as Nathan C. Johnson has developed, and in tests which will really serve as a gage of consistency. Any device will prove effective which will take away from the concreting man himself discretion as to condition of concrete and will tend to produce uniformly a desired mixture and consistency. The determination of that desired end is much more easily achieved today than the execution.

With these mechanical devices—indeed, even before they can be perfected—must come a better education of the mass of concrete workers. This might be made a subject for a long paper, so important it is. All there is space for here is to say that to penetrate the complacency of the average concrete foreman is a harder job than to educate the ignorant foreign laborer who works under him, but that until the former is made to see how little he really knows about concrete and the latter taught that rules are rules and must be obeyed, concrete will never reach the degree of perfection as a building material its possibilities warrant.

The Motor Bus as a Factor in Highway Transport

Commission Control, Franchises and Protection Against Competition Required for Successful Operation

By John N. Mackall
Chairman and Chief Engineer, Maryland State Roads Commission, Baltimore

With any good road system the logical development is the motor bus. If funds for the construction of roads are provided from the general tax, it is, of course, assumed that the construction of roads is a benefit to all of the people. All the people, however, are not owners, and never can be the owners, of motor cars. Since the indirect benefit received by the people who pay for the highways, but who do not own cars, is not sufficient to justify their paying for construction, the only possible direct benefit is through the motor bus.

With the motor bus comes the fixed schedule and direct competition with established common carriers. It has been demonstrated, and our Interstate Commerce Commission and the public service commissions of the several states are concrete evidences of this demonstration, that the public believes that practically all public services can be best rendered by a monopoly. If this is true of our railroads and water lines, of our telephones and electric light companies, it certainly does not require new demonstration in the case of bus transportation before it is accepted as a fact. This forces us to the conclusion that bus lines running upon public highways on fixed schedules are rendering a public service which can be best rendered by a monopoly, so that any road served by a bus line should be served by a single line under the control of the public service commission.

Protection for Established Lines

If exclusive franchises are to be granted for the use of a section of highway between given points to a passenger line operating on a fixed schedule, it means that the state must grant to this line protection against competition, both regular and intermittent. Frequently, the difference between the success and the failure of a bus line is measured not by the normal traffic carried, but by the extraordinary traffic on Sundays and holidays. This is the traffic on which the jitney lives, and it may be the traffic the loss of which causes the regularly established line to die. But the state cannot afford to grant exclusive privileges, even under control, and protect the line against competition, unless it can be assured that the franchise is in responsible hands, and has sufficient resources back of it to insure its operation for a sufficient period of time to demonstrate what the actual traffic is. Potential bus traffic can only be converted into actual traffic by running on a schedule, with good equipment and at a fairly close interval.

The familiar jitney bus, whether it charges a "jit" or many "jits," has demonstrated that it is but a scavenger, and fills no real need in any community. It operates only during the time when other methods of transportation are crowded, taking away from them what would be a revenue, forcing all established lines of transportation out of business and then departs for more profitable fields. Jitney transportation has always been in the hands of irresponsible people, and perhaps we can go further and say that no jitney bus was ever run when the following elements had been determined in advance: Cost of operation, overhead, insurance, interest and depreciation, and the rate to meet all of necessary charges.

If it has now been demonstrated that the service of bus transportation can best be accomplished by buses running on regular schedules with exclusive privileges, under the control of the public service commission, then we must see that the transportation companies have more than protection, that they have enough intangible assets to warrant the public in putting money into the enterprise. The writer believes that it has been demonstrated that sufficient capital cannot be attracted to this method of transportation unless the states are willing to go further and to grant these exclusive privileges for a definite number of years, and he believes that it should

ONE OF MARYLAND'S MOTOR BUSES

be from 15 to 25 years, so that capital will be attracted to motor-bus transportation, not in the hope of getting the money out before the line "hits the rocks," but in the belief that the investment is in a business which can be operated for the life of the franchise, and that during the lean years when the business is being built up, the franchise can be sold, subject, of course, to the approval of the public service commission, and that the company which built up the line may receive for its franchise rights and good will exactly what they are worth.

Certainly, in these times, capital cannot be attracted to bus transportation unless the returns are going to be very great for a short time, or unless the money can be safely invested for longer times. It is assumed in advance that the public service commissions will not permit rates which will grant enormous returns, so that moderate returns for a long term seem to be the only solution. At this time, it is obviously unnecessary to go into details of what constitutes responsibility on the part of a company, what constitutes protection on the part of the state and what constitutes service to the public. The public is interested only in service. With service must go responsibility on the part of the company and protection on the part of the state.

It is equally obvious that the state should receive an annual rental for the franchise, sufficient to justify all additional expense to which it is put by reason of maintaining the roadbed for transportation companies and granting protection to them. An amount sufficient for this purpose can be charged without in any way affecting the stability of the company. A gross receipts tax of 2 or 3 or 4 per cent will be ample to take care of this

feature and when it is considered that the bus line pays no interest on construction bonds and that it pays no cost of maintenance directly, the amount which it pays to the state may seem large in individual instances, but is small compared to what other common carriers pay.

The State of Maryland has had motor buses running on fixed schedules over its public highways, under the direct control of the Public Service Commission, and with exclusive privileges to the companies operating them, but no satisfactory progress has been made toward the solution of the problem. Because of the lack of franchise, sufficient capital could not be attracted to the lines to enable them to render adequate service during the initial period. With only few exceptions, the bus lines have been in financially irresponsible hands and additional capital could not be attracted because if the company then operating wanted to go out of business for any reason, the rights, franchise and good will which had cost many dollars to build up could not be transferred to a successor in the business.

On the other hand, if the public had been assured that any particular transportation line had privileges good for, say, 20 years, and that when their money was invested in it, it was invested for the life of the franchise, the writer believes that adequate capital could have been attracted and the lines put on a basis mutually satisfactory to the investor and to the user.

Experience in Maryland has demonstrated, at least to the writer, that adequate bus transportation can only be had by the granting of a monopoly to a company for a particular road to run buses on a regular schedule under public service commission control for a definite number of years, during which time absolute protection will be granted against competition. Otherwise, the bus transportation business will remain as it is today, a tremendous gamble in the hands of people with sufficient money to purchase one bus, to be operated with probably sufficient revenue to pay interest and current charges, but with nothing for depreciation. At the end of the life of the bus, such a line will go out of business, to be followed by another to suffer a like fate.

Hydro-Electric Work Now Under Way

In the large table on the opposite page are given the data on the large water-power plants now under construction on the Pacific Coast, and at the bottom of this page similar data are tabulated for the Eastern section of the country. These figures were obtained from answers to questionnaires sent to the respective companies and are therefore authentic.

Federal Water Power Projects Up to December, 1921

Annual Report of Commission Shows Half-Million Horsepower Under Way—Work Hampered by Lack of Funds

Extract from the Annual Report of the Federal Water Power Commission, December, 1921

IN the 16 months following passage of the Federal Water Power Act there were filed with the commission 185 applications for preliminary permit and 85 applications for license to develop water power, 260 in all, which, after deducting conflicting applications and those rejected or withdrawn, aggregated the stupendous totals of 11,060,000 primary and 5,766,000 secondary horsepower or 16,826,000 horsepower of estimated installation. This is twice the water horsepower which has been developed in the United States to date, and exceeds the combined potential water power resources of Norway, Sweden, Finland, and the Arctic and Baltic drainages of Russia. It is 70 per cent greater than the combined resources of France and Italy. It is from five to six times greater than the aggregate of all applications filed with the Federal Government during the preceding 15 years.

The country could not, of course, absorb at once all the power projected for development, and many applications may never be carried out. It is the belief, however, that the greater part of the horsepower involved will eventually be constructed. To complete the projects applied for will require capital exceeding in the aggregate two billions of dollars. The collateral expenditures for distribution systems, for customers' installation, and in accessory industries will be several times greater.

If one considers the very conservative estimate that each

HYDRO-ELECTRIC POWER PLANTS UNDER WAY IN EASTERN UNITED STATES

Company	Name of Plant	Location	Dam and Reservoir	Pipes, Canals or Tunnels	Maker of Water Wheels	Prime Movers	Static Head	Present stage of Development	Ultimate Capacity of Plant k.w.
Niagara Falls Power Co.	Extension to existing plant	Niagara Falls, N.Y.	None	Tunnel, 4,400 ft. long, 32 ft. diam. concrete lined	Not determined	Not determined	215 ft.	To be completed Summer 1922	
Henry Ford & Son, Inc.	Green Island Hydro-El. Plant	Troy, N.Y.	Federal dam across Hudson, 20 ft. high, 1200 acre ft. res.	Open ore bay 200 x 16 ft.	Allis-Chalmers	4-2,000 hp. propeller type, high speed vertical shaft.	Av. 13 ft. Max. 17 ft.	Started Apr. 1, 1921. To be completed May 31,'22	8,000 hp.
Alabama Power Co.	Mitchell Dam	Coosa River Ala.	Gravity concrete 70 ft high, 70,000 cu. ft. res.	None	Allis-Chalmers	3-24,000 hp. vert. single runner	70 ft.	Started July 1921 To be completed Apr. 1, 1923	120,000 hp.
Manitoba Power Co.	Great Falls Development	Winnepeg, Man.	Gravity concrete, 20 to 70 ft. 6,000 acre ft. res.	None	Not determined	6-28,000 hp.	56 ft.	To be completed Nov. 1923	168,000 hp.
Arkansas Hydro-El. Dev. Co.	Plant No	Little Red River	Hollow concrete, 80 ft. 154,500 cu. ft.	None	Not determined	3-5,000 hp.	70 ft.	Started June, 1921. To be completed Mar. 1922	70,000 hp.
New England Power Co.	Searsburg Plant	Searsburg, Vt.	Earth embank. 60 ft.	18,500 ft. 8-ft. wood stave pipe	I. P. Morris	1-6,200 vert. single runner	230 ft.		6,200 hp.
Southern Power Co.	Mountain Island station	Mt. Holly N.C.	Earth embankment		S. Morgan Smith	4-20,000 hp.	80 ft.	To be completed about Dec. 15, 1923	80,000 hp.
Southern Power Co.	Dearborn Plant	Great Falls, S.C.	Dam already in Duplicating existing plant		S. Morgan Smith	3-20,000 hp.	72 ft.	To be completed about Dec. 15, 1922	60,000 hp.
International Paper Co.	Sherman Island Development	Glenn's Falls, N.Y.	Multiple-arch, dam 70 ft. high.	Canal 3,500 ft. long, 40 ft. deep, 30 ft. wide at bottom and 150 at top	I. P. Morris	3-10,000 hp.	65 ft.	Started 1920. To be completed 1922	50.000 hp.

Some Pacific Coast Hydro-electric Developments Under Way in 1921 or Definitely Projected for 1922

Company	Name of Plant	Location	Dam & Reservoir	Pipes, Canals or Tunnels	Maker of Water Wheels	Penstocks	Prime Movers	Static Head Feet	Present Stage of Development	Ultimate Capacity of plant, kw.
Bridge River Power Co.	Bridge River Plant	120 mi. from Vancouver, B.C.	Simple concrete arch 157′ high. Capacity 1,250,000 acre-ft.	Two-12,800 ft. long, 12½ x 14′ concrete lined, 1,500 sec-ft. flow	Not awarded	Eight, dividing into 16 at power house 78″ to 50″ dias.	16 - 25,000 hp. double overhung impulse units	1,200	Project started middle of 1920	
B.C. El. Ry. Co.	Fourth Unit Stave Lake Plant	40 mi. East of Vancouver, B.C.			Escher Wyss Co.	One riveted steel line 14½′ dia. 170′ long	One 13,000 hp. Francis turbine	110	To be in service Mar. 1, 1922	35,400
City of Seattle	Newhalem Plant	100 mi. N.E. of Seattle, Wash.	Small diversion dam on Newhalem Creek	Length 2,675′ under 266′ pressure at lower end	Pelton Water Wheel Co.	One electrically welded line 1,122 long 33″ to 30″ dia.	One double overhung impulse unit	510	Completed in summer of 1921	
City of Seattle	Gorge Creek Plant	100 mi. N.E. of Seattle, Wash.	240′ high	Two 11,000′ long	Not awarded	Three, 1,000′ long, 11′ to 10′ dias.	Six 30,000 kva. units	395	Preliminary work under way 11,000′ tunnel contract let.	180,000
City of Seattle	Ruby Creek Plant	100 mi. N.E. of Seattle, Wash.	450′ high 1,000,000 acre-ft. storage	Length 17,000′	Not awarded		Six 45,000 kva. units	470 to 720	Gorge plant to be completed in 1923	270,000
City of Seattle	Cedar Falls Unit No. 5	About 30 mi. E. of Seattle	No additions to dam.	3 mi. of 78-in. wood stave and steel pipe, normal flow 310 sec-ft.	Pelton Water Wheel Co.	One 2,600′ penstock, 78″ to 68″ dia.	One 20,000 hp. overhung Francis turbine	630	Installation completed Oct., 1921	40,000
Washington Water Power Co.	Spokane Upper Falls	In Spokane	Inclined slab and buttresses 30′ high	None	I. P. Morris	One 370′ long. Reinforced concrete 18′ dia.	One 14,250 hp. vertical reaction turbine	64	Completed May 1, 1921	10,000
Idaho Power Co.	Shoshone Falls Plant	Near Twin Falls, Idaho	Concrete Diversion Dam 20′ high	Length 450′ 10½ x 10½′ 800 sec-ft. flow, concrete lined	S. Morgan Smith	One riveted steel line 172′ long, 10′ dia. top.	One 14,500 hp. Francis turbine	204	Headworks partially completed in 1921	11,100
City of Tacoma	Lake Cushman Project	About 60 mi. W. of Tacoma	Gravity arch 210′ high 150,000 acre-ft. storage	Length 5,300′ 14 x 20′ 700 sec-ft. flow, concrete, lined,	Not awarded	Two initial, four ultimate 3,200 long 80″ to 48″ dias.	(Initial) Two 22,500 hp. units	590	Real estate and right acquired Surveys and test borings under way	56,000
Utah Power & Light Co.	Olmstead Plant	50 mi. S. of Salt Lake City			I. P. Morris	One riveted steel line 798′ long 6′ dia.	One 7,700 hp. vertical reaction turbines unit	340		
Northwestern El. Co.	Underwood Plant	On White Salmon River	Gravity concrete dam 62½′ high			Two concrete lines 133′ long 10′ dia.	Two 4,200 hp. vertical reaction units	60	Final surveys completed	6,000
Port. Ry. Lt. & Pwr. Co.	Oak Grove	55 mi. from Portland	Earth fill 22′ high	¾ mile conduit			One 27,500 hp. reaction turbine	860	To be completed in 1924	
California Oregon Power Co.	Copco Unit No. 2	2 mi. S. of Calif.-Ore. State line	Raise water level 14′ behind present dam	None	Allis-Chalmers	200′ long 16′ dia. top and bottom, riveted steel	One 10,000 kw. horizontal reaction turbine	125	To be in service in latter part of 1922	20,000
Pacific Gas & Elec. Co.	Drum Plant Unit No 3.	Bear River Placer County	Previously constructed		Pelton Water Wheel Co.		One 20,000 hp. double overhung impulse unit	1,375	In course of installation	12,000
Pacific Gas & Elec. Co.	Hat Creek No1.	Hat Creek 245 mi. N. of S. F.	Small timber crib diversion dam	Half mile canal 600 sec-ft. flow	Wellman Seaver Morgan	One riveted steel line 1,605′ long 10′ to 8′ dias.	One 15,000 hp. vertical reaction	217	In service	10,000
Pacific Gas & Elec. Co.	Hat Creek No.2	245 mi. N. of S. F	Small timber crib diversion dam	4,500′ of flume 800 sec-ft. flow	Wellman Seaver Morgan	One riveted steel line 413′ long 10′ to 8′ dias.	One 15,000 hp. vertical reaction turbine	198	In service	10,000
Pacific Gas & Elec. Co	Pit River No. 1	245 mi. N. of S. F.	Diversion weir	Length 10,160′ 14′ dia. concrete lined, 1,800 sec-ft.	Allis-Chalmers	Two riveted steel and lap-welded lines 1,372′ long 10½′ to 8′ dias.	Two 40,000 hp. vertical reaction turbines	440.5	To be completed in 1922	63,000
Gt. Western Power Co.	Caribou Plant	195 mi from S. F. on Feather River	Previously constructed	20,400′ of tunnel 7 x 7′ to 10′ circular	Allis-Chalmers	Two riveted steel lines 2,082′ long 66″ to 42″ dia.	Two 30,000 hp. double overhung impulse wheels	1,008	Completed summer of 1921	120,000
City of San Franscisco	Moccasin Cr. Plant	140 mi. E. of S. F.	Hetch Hetchy dam 226′ high 30,600 acre-ft.	18 miles of 10 x 13 ft. tunnel 620 sec-ft. capacity	Not awarded	Three line 4,700′ long 104″ to 52″ dias.	Three or four 25,000 hp. double runner impulse wheels	1,325	Construction under way. Plant to be completed in 1923	150,000
Turlock & Modesto Irrigation Districts	Don Pedro Plant	Tuolumne River above Lagrange	Gravity concrete dam 283′ high. 270,000 acre-ft. storage	Power house monolothic with dam	S. Morgan Smith	Three reinforced concrete tubes in dam 200′ long 6 dia.	Three 6,700 hp. reaction turbines	160 to 240	Started June 1921	70,000
San Joaquin Lt. & Pwr. Corp.	Balch Power House	Kings River	Multiple arch, 150′ high 45,000 acre-ft. storage	Length 27,000′ 12′ dia. unlined 400 sec-ft. flow	Not awarded	Four lap-welded lines 5,425′ long 48″ to 24″ dias.	Two 44,000 hp. impulse wheels	2,495	Construction to start April, 1922	108,500
San Joaquin Lt. & Pwr. Corp.	Kern Canyon Plant	18 mi. N. E. of Bakersfield	Diversion dam 15′ high at tail-race of Kern River No. 1	Length 8,300′ 11′ circular 800 sec-ft. flow	Allis-Chalmers	One riveted steel line 568′ long 8′ to 7′ dias.	One 12,000 hp. vertical Francis turbine	230	In service summer of 1921	18,000
So. Cal. Edison Co.	Kern River No. 3	130 mi. from Los Angeles	Concrete diversion dam 25′ high	12 mi. 8 x 8½ ft., chiefly lined with concrete 600 sec-ft. flow	Pelton Water Wheel Co.	Two riveted and weld. steel lines 2,520′ long 7′ to 5′ dias.	Two 22,500 hp. single runner vertical reaction turbines	806	In service summer of 1921	32,000
So. Cal. Edison Co.	Big Creek No. 8	241 mi. from Los Angeles	Concrete diversion dam 60′ high	Length 5,600′ 20 x 20′ unlined 2,050 sec-ft. flow	I. P. Morris Co.	One riveted and welded steel line 2,700′ long 8′ to 6′ dias.	One 30,000 hp. vertical reaction turbine	729	In service August, 1921	135,000
So. Cal. Edison Co.	Big Creek No. 3	235 mi. from Los Angeles	Small diversion dam	Length 30,000′ 21 x 21 3,000 sec-ft. flow	Not awarded		Three 35,000 hp. units	1825	Tunnel Started Nov., 1921	150,000
Sespe Lt. & Pwr. Co.	Santa Paula Project	Sespe Creek Ventura Co. Cal.	Six multiple arch dams 115 to 245′ high						Preliminary work started in 1921	Tot. for six plants 28,500
Southern Sierras Pwr. Co.	Forest Home Plant	16 mi. from San Bernardino	Rock fill dam, 80′ high	5.6 mi. of wood stave pipe, normal flow 20 sec-ft.	Not awarded	One, 6,330′ long 24″ to 18″ dias. riveted steel	One 2,500 kw. impulse wheel	2,047	Work on plant to begin June, 1922, to be in service one year later	2,500
Nevada-Cal. Power Co.	Levining Creek Plant	314 mi. from San Bernardino.	Three rock fill timber face dams, 45 to 57′ high	2,200′ unlined tunnel, normal flow 40 sec-ft.	Not awarded	One, 40″ to 32″ dias.	One 17,900 hp. impulse wheel	1,670	Dams 60% complete Jan. 1, 1922	12,500

horsepower of developed energy, used industrially, means employment for one skilled workman, the possibilities as a national asset latent in the 16,826,000 hp. represented by applications now before the Commission will readily be appreciated.

Final Action on Some Projects

Up to Nov. 1 final action has been taken on 89 applications, in which 27 preliminary permits and 31 licenses were authorized, involving 1,413,600 primary and 2,627,000 installed horsepower. Of the projects under license construction is now under way on those noted in the accompanying table:

WATER POWER PROJECTS UNDER FEDERAL LICENSE NOW UNDER WAY

	Horsepower	
	Primary	Installed
Henry Ford & Son, Inc., Hudson River, N. Y.	3,640	8,100
Niagara Falls Power Co., Niagara River, N. Y.	341,500	572,230
Southern California Edison Co., Big Cr., Calif.	165,000	545,000
Alabama Power Co., Coosa River, Alabama	21,760	110,000
Snow Mountain Power & Water Co., Eel River, California	9,500	16,670
Western States Gas and Electric Co., American River, California	6,400	6,400
Wisconsin-Minnesota Light & Power Co., Chippewa River, Wisc. (preliminary construction only)	10,000	20,000
Total	557,800	1,276,400

The commission's serious need is for Congressional authorization which will permit the use of its appropriations in employment of personnel sufficient to make up a small organization of trained and experienced men capable of meeting intelligently the important and perplexing engineering and economic problems which are constantly arising and upon the correct solution of which will depend the value of federal legislation and, in no small degree, the future of the electric power industry. The Comptroller of the Treasury having ruled that the commission could employ no person other than its executive secretary, but must rely entirely upon assignment or detail of individuals from the several executive departments, it has been necessary to proceed on that unsatisfactory basis. Recommendation is made that immediate steps be taken to amend the Federal Water Power Act, at least to the extent necessary to permit the commission to employ its own personnel.

More Assistants Needed

It is pointed out that a satisfactory general law has been passed, but its full benefits are not being received because of lack of adequate means for its administration. Until the situation is corrected the commission must pursue one or two courses—carry out the provisions of the law, act only upon such applications as it can handle in compliance with the law and defer action indefinitely upon the remainder; or ignore the requirements of the law, issue permits or licenses without adequate investigation, without making the valuations required by the act and without enforcing the safeguards provided by the act. As industrial conditions improve, there will be pressing need for more and cheaper power. This can be supplied to the degree needed only from the sources under federal control. Instead of further delay the government should be bending every effort toward releasing under reasonable safeguards the water powers it has been hoarding for so many years.

Much time and care has been devoted during the year to compilation of the rules and regulations governing administration of the Federal Water Power Act. The first ten regulations included matters which had been covered in considerable degree by regulations under earlier laws. The remaining subjects to be covered were largely new, concerned matters not hitherto involved in federal administration, and required a careful study of the act and the consideration of legal, economic, and financial questions of considerable complexity. In the preparation of these regulations advice and criticism were freely sought in order that the regulations, when adopted, might be suited to the actual conditions surrounding electric-power development. Final amendments were adopted by the commission on May 28 and promulgated on June 6, 1921.

New York Port Authority Submits "Comprehensive Plan"

Scheme Includes Most of Details of Report of Bi-State Commission, but Adds Motor Truck Delivery for Immediate Relief

IN COMPLIANCE with provisions of the acts creating it, the Port of New York Authority, under date of Dec. 21, 1921, submitted to the legislatures of New York and New Jersey the "Plan for the Comprehensive Development of the Port of New York." This "comprehensive plan" had to be submitted before the beginning of this year, and it will have to be approved by the two legislatures before the Authority can begin to function as a governing body, or before it can embark on any of the enterprises it has planned. Except for some changes in routing of the various belt-lines and some emphasis on a scheme for immediate relief of freight congestion by means of motor truck distribution, the plan is about the same as the one submitted a year ago by the New York-New Jersey Interstate Port and Harbor Commission. (See *Engineering News-Record*, Jan. 27, 1921, p. 177; Feb. 10, 1921, p. 271.) That is, there are the various systems of belt-lines, inner and outer, including a tunnel across New York Bay from Bayonne to Brooklyn and the automatic electric conveyor in tunnel under the Hudson and under Manhattan.

Fundamental Principles

The fundamental principles of the scheme are stated as follows:

First—That terminal operations within the Port District, so far as practicable, should be unified;

Second—That there should be consolidation of shipments at proper classification points so as to eliminate duplication of effort, inefficien t loading of equipment and realize reduction in expenses;

Third—That there should be the most direct routing of all commodities so as to avoid centers of congestion, conflicting currents and long truck-hauls;

Fourth—That terminal stations established under the comprehensive plan should be union stations;

Fifth—That the process of co-ordinating facilities should so far as practicable adapt existing facilities as integral parts of the new system, so as to avoid needless destruction of existing capital investment and reduce so far as may be possible the requirements for new capital; and endeavor should be made to obtain the consent of the States and local municipalities within the Port District for the co-ordination of their present and contemplated port and terminal facilities with the whole plan;

Sixth—That freight from all railroads must be brought to all parts of the port wherever practicable without cars breaking bulk, and this necessitates tunnel connection between New Jersey and Lond Island, and tunnel or bridge connections between other parts of the port;

Seventh—That there should be urged upon the federal authorities improvement of channels so as to give access for that type of waterborne commerce adapted to the various forms of development which the respective shorefronts and adjacent lands of the port would best lend themselves to;

Eighth—Highways for motor truck traffic should be laid out so as to permit the most efficient inter-relation between terminals, piers and industrial establishments not equipped with railroad sidings and for the distribution of building materials and many other commodities which must be handled by trucks; these highways to connect with existing or projected bridges, tunnels and ferries.

Ninth—Definite methods for prompt relief must be devised that can be applied for the better co-ordination and operation of existing facilities while larger and more com-

prehensive plans for future development are being carried out.

After reiterating the arguments made by the previous commission in favor of its general plan, which include the general principle that the Manhattan waterfront must be released for ocean steamers, the Jersey waterfront reserved for railhead connections from rail to ship and that break-up stations should be west of the Bergen hills and inland in Manhattan, the report outlines the "comprehensive plan" as follows:

The keystone to the arch of the structure which we term the "comprehensive plan" is the medium of connections between the two sides of the port. This keystone is, therefore, the necessary belt line connecting all of the nine railroads on the westerly side of the port, together with a tunnel under the bay and belt line to connect them with the three trunk lines on the easterly side of the port. In locating these there are two main factors to be considered i.e., the purely physical factor and the service factor. The location of this belt line on the westerly side and of the tunnel was determined by many impelling reasons and only after very intensive study.

The chief reasons are:

(a) That in this location can be made the shortest connecting link between all of the railroads terminating on the west side of the port,

(b) That it lies adjacent to and easterly of the existing breakup and classification yards of each of those railroads, with which it can be readily connected;

(c) That the cars from trains broken up and classified in those yards will then continue to move to this shortest connecting belt line by the shortest and most direct route and in the right direction;

(d) Conversely, that the same principle applies to westbound movements;

(e) The proposed tunnel from Greenville to Bay Ridge is the straightest, shortest and most direct course from that belt line to the easterly side of the port. It is the most favorable location for construction, for freedom from interference by moving craft during construction, for under-water depth below which any permanent structure must be built, for absence of curves and for easy grades.

Considered, therefore, merely from the physical aspect of tunnel construction alone, this location has the most advantages. Considered from the question of short connections and approaches, both the physical and operating elements make it the best.

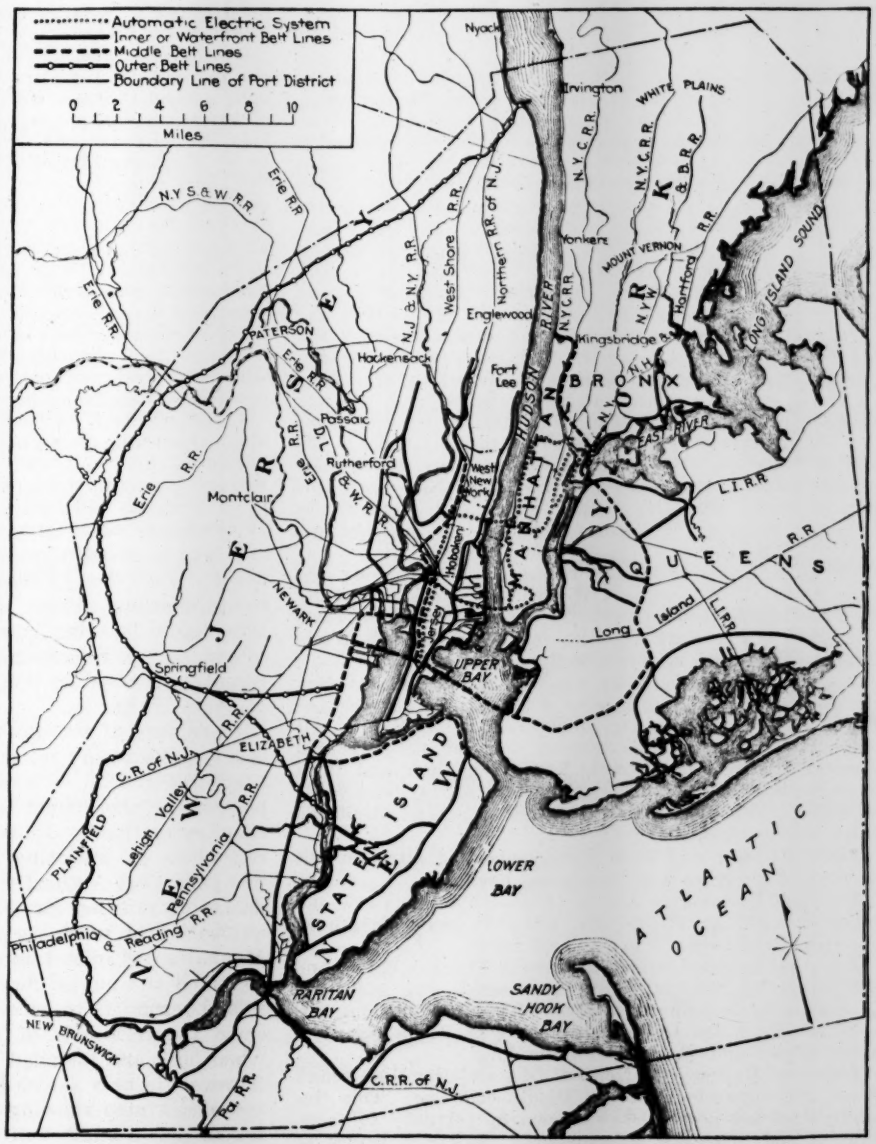
It is by means of this same belt line that at appropriate locations there can be established suitable facilities for the consolidation of the car float and lighterage movement that must continue.

The belt line on the easterly side forming the through connecting is an existing unit. Many other belt lines will be necessary to promote and serve industrial developments and water fronts. These form an essential part of the comprehensive plan and their location has been fully discussed with and generally approved by the various localities to be served. They are located so as to co-relate their local improvements.

Middle Belt Line—The keystone of the arch of railroad terminal co-ordination within the Port District. It connects New Jersey and Staten Island and the railroads on the westerly side of the port with Brooklyn, Queens, the Bronx and the railroads on the easterly side of the port. This connection is the most direct, the shortest and the cheapest of any brought to the attention of the Commissioners for study or consideration.

Its length is approximately 61¼ miles, of which approximately 51¼ miles have already been built.

The route of the Middle belt line is as follows: Commencing at the Hudson River at Spuyten Duyvel running easterly and southerly generally along the easterly side of the Harlem River, utilizing existing lines and improving



MAP SHOWING BELT-LINE AND MANHATTAN AUTOMATIC RAILWAYS IN PORT AUTHORITY'S COMPREHENSIVE PLAN

and adding where necessary, to a connection with Hell Gate Bridge and the New Haven R.R., a distance of approximately seven miles; thence continuing in a general southerly direction, utilizing existing lines and improving and adding where necessary, to a point near Bay Ridge, a distance of approximately 18½ miles; thence by a new two-track tunnel under New York bay in a northwesterly direction to a portal in the Greenville yard of the Pennsylvania Railroad in Jersey City, a distance of approximately 5 miles, to a connection with the tracks of the Pennsylvania and Lehigh Valley R.R.; thence in a generally northerly direction along the easterly side of Newark Bay and the Hackensack River at the westerly foot of the Palisades, utilizing existing tracks and improving and adding where necessary, making connections with the Jersey Central, Pennsylvania, Lehigh Valley, Delaware, Lackawanna & Western, Erie, New York, Susquehanna and Western, New York, Ontario and Western, and West Shore railroads, a distance of approximately 10 miles. From the Greenville portal of the Bay tunnel and from the line along the easterly side of Newark Bay by the bridges of the Central Railroad of New Jersey (crossing the Hackensack and Passaic rivers) and of the Pennsylvania and Lehigh Valley R.R. (crossing Newark Bay) to the line of the Central Railroad of New Jersey running along the westerly side of Newark Bay and thence southerly along this line to a connection with the Baltimore & Ohio R.R. south of Elizabethport, utilizing existing lines and improving and adding where necessary, a distance of approximately 12 miles; thence in an easterly direction crossing the Arthur Kill, utilizing existing lines and improving and adding where necessary, along the northerly and easterly shores of Staten Island to the new city piers and to a connection, if the City of New York consent thereto, with the tunnel under the Narrows to Brooklyn provided for under legislation as a municipal project—a distance of approximately 9 miles.

Marginal Railroad in the Bronx extending along the shore of the East River and Westchester Creek connecting with the Middle belt line (No. 1) and with the New York, New Haven and Hartford R.R. in the vicinity of Westchester. Its length is approximately eight miles.

Marginal Railroad in Queens and Brooklyn extending along Flushing Creek, Flushing Bay, the East River and Upper New York Bay. It connects with the Middle belt line. It utilizes certain existing lines of the Brooklyn Eastern District, Jay Street, New York Dock and Bush Terminal companies. It has a length of approximately 19½ miles, of which approximately 4 now exist and about 15½ miles will be new.

Short Existing and New Lines connecting up main belt lines and serving as minor marginal lines.

Marginal Railroad on Jamaica Bay—This line is new and connects with the Middle belt line. It has a length of approximately twelve and one-half miles.

Marginal Railroad on Staten Island—This line is new and will open up territory for commercial and industrial development. It connects with the Middle belt line and with a branch from the Outer belt line; with its branch it is about fifteen and one-quarter miles long.

Marginal Railroad on Newark Bay and the Hackensack River and connects with the Middle belt line. This line which does not now exist will open up territory for commercial and industrial development. It has a length of approximately seven miles.

Marginal Railroad extending along the westerly side of the Hudson River and the Upper New York Bay. It is made up mostly of existing lines—the Erie Terminals, Jersey Junction, Hoboken Shore, and National Docks railroads. It is to be improved and added to where necessary. It has a length of approximately 16½ miles of which about 15 miles now exist.

Marginal Railroad connecting with the middle belt line and extending through the Hackensack and Secaucus Meadows. It will open up territory for commercial and industrial development. It is a new line and has a length of approximately 23 miles.

Outer Belt Line, extending around the westerly limits of the Port District beyond the congested section. Its northerly terminus is on the Hudson River at Piermont above the harbor congestion and it connects by marginal railroads at the southerly end with the harbor waters below the congested section. By spurs it connects with the Middle belt line on the westerly shore of Newark Bay and with the marginal railroad on the westerly shore of Staten Island. It will have great value in that it will afford military protection to the Port District. It will serve as an interchange between the railroads beyond the congestion and will open up territory for industrial development. It has a length of approximately 71 miles which is all new construction.

Automatic Electric System for serving Manhattan Island Its yards will connect with the Middle belt line and with all the railroads of the Port District. It is a standard gage underground railroad deep enough in Manhattan to permit of two levels of rapid transit subways to pass over it. The only standard railroad cars that will be brought through to its Manhattan terminals will be those with perishables and food products in refrigerator cars. Cars with merchandise freight will be stopped at its yards. Freight from standard cars will be transferred on to wheeled containers, thence to special electrically propelled cars which will bear it to Manhattan. This frieght will be kept "on wheels" between the door of the standard freight car at the transfer point and the tailboard of the truck at the Manhattan terminal or the store door as may be elected by the shipper or consignee, thus elminating all extra handling. Freight cars will thus be released more quickly from the terminals, thus effecting a material saving in the use of railroad equipment.

Union terminal stations located on Manhattan in zones of equal trucking distance, as to pick-ups and deliveries, will be served by the system. These terminals will contain storage space and space for other facilities. The automatic electric system will bring all the railroads of the port to Manhattan on equal terms as to time, service and cost.

It will be noted that these belt-lines, different in some details from those indicated in the earlier report, the most important divergence being the connection from the Middle belt-line into the middle section of Staten Island, where it connects with the Narrows tunnel line, recently proposed by the Board of Estimate of the City of New York.

In defense of the automatic railway freight delivery scheme, the report reiterates the arguments of the Bi-State report, but it notes that the execution of this part of the plan "must be a process of evolution rather than revolution." In recognition, apparently, of the difficulties in initiating such a radical and expensive plan, the Port Authority recommends the early consolidation of railroad car float and lighterage service, the unification of truck services and the establishment on Manhattan of inland union terminals serving such consolidated and unified floating and truck operations "the inland terminals to be so designed and placed as to become the terminals of the automatic electric system when built and installed." The plan for present relief, however, is only sketchily treated in the report, which includes a map showing the subdivision of Manhattan Island into a number of "trucking zones" with interior and waterside terminal stations.

No details are given of the manner in which the Authority proposes to raise the funds necessary for its works, except by stating that financing is a function independent of taxing powers and that it will be carried on as in similarly constituted bodies here and abroad. Nothing is given as to possible costs, nor, in any definite fashion, of the chronological precedence of various parts of the scheme.

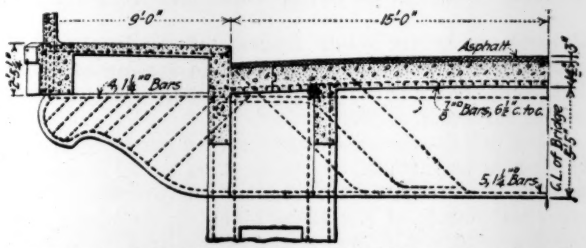
The report contains maps showing the "comprehensive plan," the relation of that plan to the several port and terminal schemes proposed by various municipalities in the port district, detail maps of those separate schemes

and an outline map indicating proposed highway routes in connection with the port.

The report is signed by all the members of the Port of New York Authority: For New York, Eugenius H. Outerbridge, chairman, Alfred E. Smith and Lewis H. Pounds; for New Jersey, J. Spencer Smith, chairman, De Witt van Buskirk and Frank H. Ford. W. W. Drinker is terminal engineer, E. C. Church, transportation engineer, J. A. Jackson, electrical engineer and Nelson P. Lewis, Morris R. Sherrerd and Francis Lee Stuart, members of the Technical Advisory Board. B. F. Cresson, Jr., is chief engineer and George W. Goethals, consulting engineer.

Independent Floor-Beams and Slab in New Concrete Arch Bridge

IN ORDER to simplify the floor forms in the construction of a large concrete arch bridge now being built in Pittsburgh, the engineers designed the slab and floor-beams as independent elements, the slab to rest on top of the completed floor-beams. In construction, the

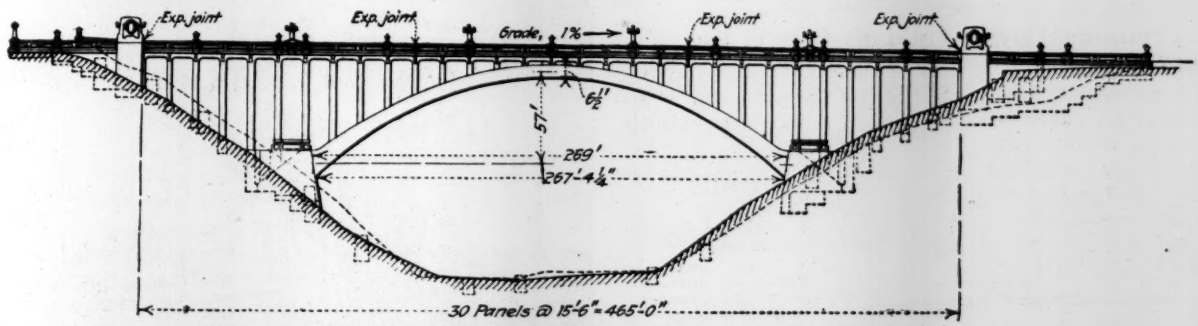


DECK CONSTRUCTION OF BEECHWOOD BLVD. BRIDGE

spandrel columns resting on the arch ribs and the floor-beams will be concreted in forms built up from the ribs and subsequently, after removal of these forms, the forms for the floor slab and the fascia stringers on either side will be built between the floor-beams and supported by them. This avoids the necessity of carrying the heavy floor forms and slab by supports extended up from the arch rib. No definite plane of separation between slab and beams is provided except that formed by the construction joint, and on the contrary the floor-beam diagonal reinforcement is allowed to extend up into the slab. But the beam is designed as though it terminated at the bottom line of the slab rather than as a beam extending to the top of the slab or as a T-beam utilizing part of the slab for compression area.

As shown in the accompanying drawing, the bridge, which is of exceptionally handsome outline, is a two-rib parabolic structure with open spandrels, of 267 ft. 4½-in. span between faces of abutments, or 279 ft. between theoretical springing lines, and 57 ft. theoretical rise, or 55.89 ft. rise of intrados. It will carry Beechwood Boulevard across the depressed Saline St. at the entrance to Schenley Park. A sketch of the normal floor-beam construction is given in the drawing. The floor panels are 15½ ft. long, center to center of floor-beams. The two arch ribs, 26 ft. apart on centers, are each 8 ft. wide, with a crown depth of 6½ ft. They are reinforced with eight angles 6 x 4 x ¾ in., connected at intervals of 3 ft. by encircling tie bars 2¾ x ⅜ in.

The bridge was designed by Assistant Engineer Appel of the bridge division, Department of Public Works.



GENERAL FEATURES OF BEECHWOOD BOULEVARD BRIDGE

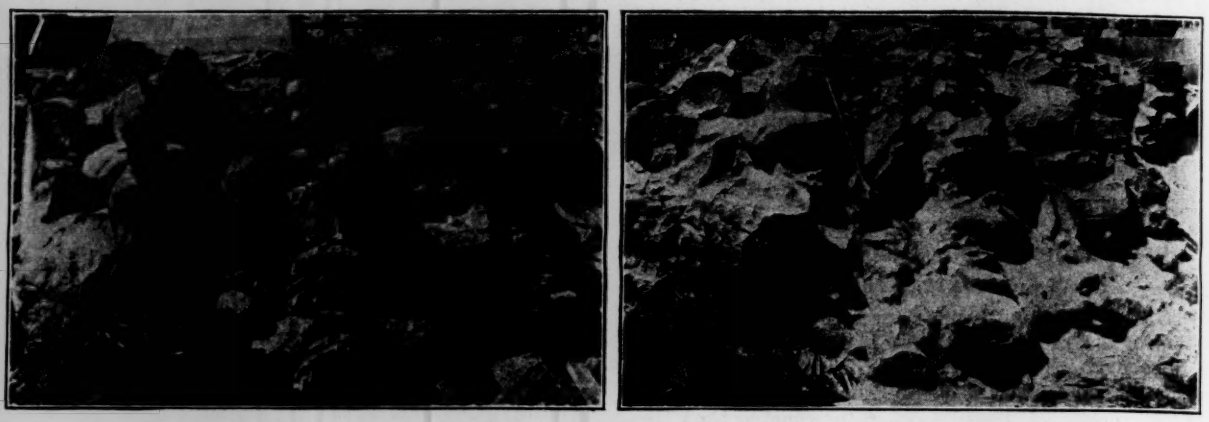
Progress of Federal Reclamation

THE annual report of Arthur P. Davis, director of the U. S. Reclamation Service, shows that the works of the Reclamation Service in the arid and semi-arid states of the West served in the fiscal year 1920-21 areas agrgegating 2,845,000 irrigable acres, including 1,662,000 acres for which the government systems furnished the sole supply of irrigation water, and 1,183,000 acres to which in most cases the Service furnished stored water in bulk to supplement the partial supply of private systems otherwise dependent on unregulated stream flow Of the first class, 1,224,000 acres were actually irrigated and 1,154,000 harvested producing crops to the value of more than $66,000,000. Of the other class, from less complete information, it is roughly estimated that 982,000 acres were irrigated and 950,900 cropped, producing crops to the value of $47,500,000, or a grand total of nearly $114,000,000. Within the projects constructed by the Service are 32,835 irrigated farms with a total population of more than 125,000.

Since the government works began the delivery of irrigation water, the crops produced on the reclaimed lands have exceeded $400,000,000 in value. This includes nothing for the large areas under private systems served government water and does not include increased values produced as livestock and stock products. The increase in the value of lands is estimated to amount to over $500,000,000 based on government reclamation work.

At the end of the fiscal year the service had constructed 100 storage and diversion dams; more than 13,000 miles of canals, ditches and drains; 109,000 canal structures and 7,700 bridges. It had built 1,000 miles of roads, 83 miles of railroad, 4,000 miles of telephone and transmission lines and had excavated over 188,000,000 cu.yd. of earth and rock, over 9,000,000 of which was excavated in the past fiscal year.

HINTS FOR THE CONTRACTOR



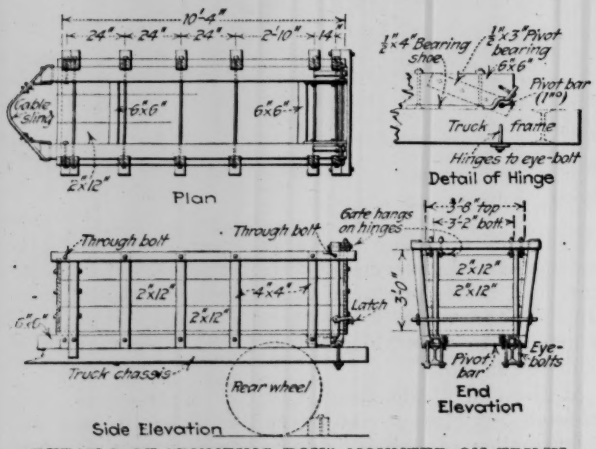
BEFORE AND AFTER COATING ROCK FACE WITH GUNITE IN POWER HOUSE TAILRACE

Gunite Protection For Loose Rock Wall

A ROUGH hand placed rock facing on an embankment near the tailrace of the San Joaquin Light & Power Corporation's Kern Canyon plant was so located that it might be submerged and subject to strong water current during high water. In order to strengthen the face against damage from this cause, the cement gun was used to bond the rocks and gravel together and give the slope a smooth, comparatively impervious coating. The result of this treatment, shown in the accompanying illustration, was a highly satisfactory job at low cost. A vertical face of boulders held in place by a clay bearing gravel like a conglomerate, which was left by the excavation of the tailrace was treated in the same manner.

Dumping Device Unloads Gravel Boxes

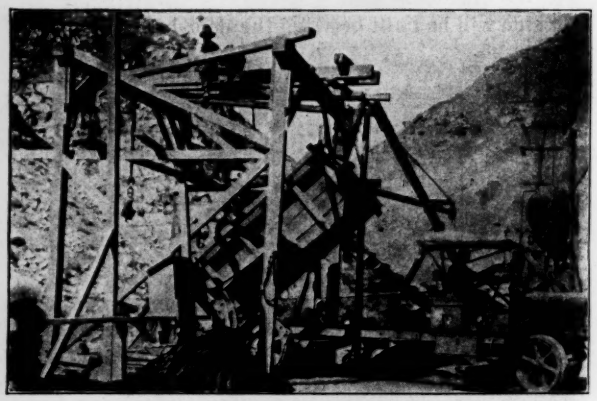
IN CONSTRUCTION work recently carried out by the San Joaquin Light and Power Corp. it was occasionally necessary to haul gravel in rather large quanti-



DETAILS OF "DUMPING BOX" MOUNTED ON TRUCK

ties by motor truck. The company did not own any motor trucks equipped with dump bodies but had on hand plenty of ordinary trucks. If the requirements had been for continuous gravel haul, it might have been advisable to secure dump trucks, but, under the circumstances, it was found expedient to use gravel boxes that could be removed quickly when the trucks were needed for other service.

A box design was accordingly worked out by means of which a hoist installed at the bunkers would dump the load as effectively as the regular dump trucks. The boxes were made of 2 x 12-in. planking, well braced to a frame of 6 x 6-in. and 4 x 4-in. timbers. The rear end of the box was hinged to the truck body, the hinge constituting a center line about which the box would swing when the front end was raised. Five-ton trucks were used and a ½-in. strap iron bearing shoe, 4 in.



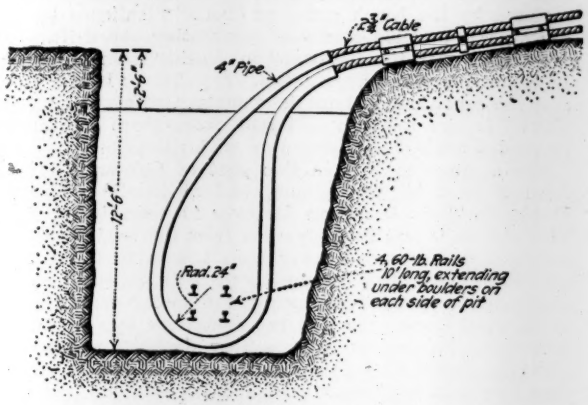
GRAVEL BOX IN RAISED POSITION UNDER GALLOWS FRAME

wide and about 18 in. long was provided at the rear end of the box on the underside of the 6 x 6-in. timber to transfer the weight at the hinge point to the I-beam of the truck chassis.

The lifting was done by an air hoist mounted on a gallows frame over the dumping platform at the storage bins. The hoist operated a 4-part block and tackle that attached to a cable sling on the front of the box. When boxes were to be removed the hinge joint was unbolted and the hoist raised box from the chassis. The boxes had a capacity of 3.92 cu.yd. and were lined with 12-gage iron to prevent wear of the planking.

Cable Strength Developed in Anchor

A METHOD of fastening 2¾-in. cable to an anchorage without sacrificing any of its strength was employed on cableways used recently in the construction of the Kern Canyon plant of the San Joaquin Light & Power Corp, near Bakersfield, Cal. When the concrete anchorage was being cast, there was imbedded in it a 4-in. pipe bent in the form of a loop with both ends projecting on top of the anchorage, the minimum radius being about 2 ft., as shown in the accompanying drawing. When the concrete had hardened the end of the cable to be anchored was welded to the end of a ½-in. cable which was passed through the pipe and used to pull the main cable through. The end of the cable was then made fast by five Crosby clamps 30 in. apart with clips in between. The pipe was filled with grease before the main cable was pulled through. This made it easy to get the cable in and out, and meantime, with the aid of waste stuffed in the ends of the pipe, prevented rusting. After the completion of the work the cable was easily removed and its entire length salvaged



A CONVENIENT METHOD OF ANCHORING HEAVY CABLE

A Barrel Water Heater for Building Work

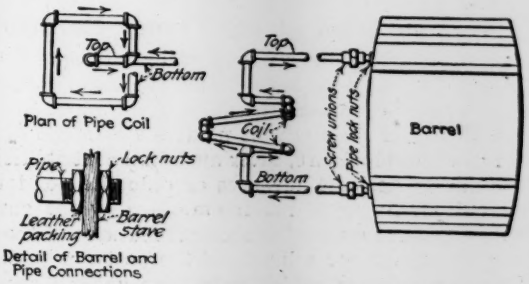
BY B. FRANCIS DASHIELL
Dunkirk, Md.

A WATER heater for building operations, such as mixing concrete, plaster, mortar, etc., during freezing winter weather is shown by the drawing.

The heating coil is made up of elbows and short lengths of pipe built up in the shape of a square, with the sides slanting to provide a continuous spiral drain from top to bottom. A large barrel is used as the reservoir for the water. The coil is connected to the barrel with pipe lock nuts, leather washers being placed between the nuts and the staves as shown in the detail. Screw pipe unions are placed next to the barrel so that the coil can be detached when removing the outfit.

In operation, the barrel is placed upon a stand so that the coil will be at the proper height above a fire built underneath to be in the hottest part of the blaze. A tight fitting cover should be provided for the barrel as the water will heat more quickly and when once hot will stay so as long as the fire is kept going and water is furnished to keep the barrel filled above the upper pipe connection from the coil.

A simple pipe coil can be used in place of the built up coil, but its construction requires the services of a skilled blacksmith to bend the coils and costs more than the one shown, for which odd pipe pieces and old fittings are used by anyone handy with a wrench.



WATER HEATER FOR COLD WEATHER CONSTRUCTION

Reinforcing for 65-Ft. Cylinder Pier Placed as Unit

LIFTING THE 11-TON CAGE INTO PLACE

IN PUTTING in the piers for two spans of the Long Beach, Long Island bridge, which connects Wreck Lead with Long Beach, cylinders of an unusual length were used. Placement of reinforcing steel became a problem, and this the contractor solved by building up the steel in squirrel-cage fashion, raising the whole by a derrick and lowering it into the cylinders. The squirrel cages were built upon circular templets made of double segmental layers of 2-in. lumber. To these were fastened the 1-in. vertical reinforcing bars, spaced on 6-in. centers. In one of the piers the cages attained a length of 65 ft., the templets being spaced about 8 ft. apart.

Circular reinforcement used was ⅝-in. steel rods spaced on 2-ft. centers and to make the whole positive from breaking ⅝-in. rods were fastened spirally at about 18-in. centers. When the cages had been made up they were hoisted into vertical position and lowered by a floating derrick with an 80-ft. boom. As the cages were lowered the templets were cut out.

In the accompanying photograph the squirrel cage for one of the 65-ft. steel cylinders is being hoisted into position.

The contractor who devised this system was the McLean Contracting Co., Baltimore, and the bridge is being constructed by Nassau County, N. Y., with W. Fred Starks in charge for the county.

Reorganization of the French Railroads

OPERATION of the six main railway lines of France under a single agreement with the state; pooling of net revenues into a common fund, from which any deficits of weaker lines will be paid; maintenance of this fund at a specific figure, after an initial contribution by the state, by periodic advances or reductions of tariffs, as required; fixing of maximum rates by the government—these are some of the salient features of the proposed legislation for solution of the post-war problems of French railways, which have been under discussion at public hearings for some months by committees of the Senate and Chamber of Deputies and which will probably be enacted into law by the end of the calendar year, according to a recent bulletin published by the Department of Commerce.

The proposed law provides for a supreme council in which the operating companies, the government, and the public will be represented. This body will formulate the future policies of the railways, which will be binding on all the companies. In all matters of general policy the government will exercise a supervisory control, leaving to the corporations the actual administration and operation of the lines. The state guarantees operating expenses, bonded indebtedness, and preferred dividends, thus making it easy for the lines to raise the large amount of capital necessary for improvements and extensions.

Detailed plans and estimates have been prepared for the electrification of 5,000 miles of railways. The enormous advance in the cost of coal in recent years has given impetus to the utilization of the water-power resources of the nation in electrifying rail lines. Power stations operated with coal will be used in the vicinity of Paris and other large cities to supplement the hydro-electric plants.

Through connections, now definitely planned, will better the communication with Central Europe, the Near East, and the Orient. A line, passing through Nantes, La Rochelle, Bordeaux, and Lyons, will reach Switzerland, Northern Italy, Czechoslovakia, the Danubian countries, the Balkans, and Constantinople; also through Switzerland, Vienna, and Budapest. Another line, more to the north, is planned to pass through Harve, Paris, Strassburg, Prague, and Cracow to Kieff, and will form the western section of the proposed Eurasian Transcontinental line from the Atlantic to the Pacific.

The total length of line now in actual operation, including the Alsace-Lorraine railways which have become an integral part of the French transportation system, is 26,250 miles. About 761 miles are under construction and 688 miles of new lines are projected.

Railroad Accidents

An analysis of the latest Interstate Commerce Commission figures on the annual accident records of all railroads within the United States, prepared by the Committee on Accident Statistics of the American Railway Association, shows that fewer people were killed in 1920 than in any year since 1898. In that year the number of passengers killed was 315, while last year the official records show only 229. Although the total number of employees in the railroad service is several times greater than in 1891, the fatal injuries to employees in 1919 and 1920 were less each year than they were twenty-nine years ago.

LETTERS TO THE EDITOR

This department aims to be a forum for the discussion of the views of engineers and contractors. The range of interest should be as wide as possible. Contributors are, therefore, asked to make their letters short.

Beach Grass As Sand Shifting Preventive

Sir—It is not known just what amount of moisture is required by the beach grass or "helm" mentioned by Mr. Kooy as a possible means of preventing the drifting of dune sand over the highways in southwestern California. (*Engineering News-Record*, Oct. 27, p. 701.) It is believed that the conditions in Imperial County, California, affecting plant life are radically different from those in Holland, where his method has been used with success.

The average rainfall in this part of California is only from 3 to 4 in. per annum, and at Sterling, formerly Mammoth Tank, the mean for over 40 years is but 2¼ in. This station is less than 60 miles from the road mentioned. Incidentally, snow has never been known to fall on this territory. Such beach grasses as grow along the California coast rely a great deal upon the fogs for moisture, but in Imperial County, back of the mountains fogs are almost unknown. Consequently, it is very doubtful whether the climatic conditions here are such as to allow the cultivation of plants to prevent sand drifting over the highways.

R. A. HILL,
With Quinton, Code & Hill,
Nov. 21, Los Angeles. Consulting Engineers.

Purifying Shellfish by Electrolytically Sterilized Sea Water

Sir—I should like to make note of a simple method of disinfecting sea water used in purifying shellfish. Shellfish are to be purified by "floating" in salt water of good sanitary quality, to which a sterilizing substance is added at intervals. The process starts with a "sterilizing interval," during which the water contains an excess of sterilizing material sufficient to sterilize everything exterior to the shells. This is followed by a "drinking interval," during which the shellfish exercise their natural functions in clean water, free from infective matters. A second sterilizing interval follows, to sterilize all material eliminated by the shellfish during the preceding functioning interval. This is again followed by a drinking interval. This alternation of sterilizing and drinking intervals is continued until the shellfish are purified to the extent required by given sanitary standards.

Such a shellfish purification plant operating at Inwood, L. I., will be more fully described in a later issue of *Engineering News-Record*. An electrolytic "cell" was installed to generate the hypochlorite solution directly from the sea water. Ordinarily these "cells" are designed to produce a hypochlorite solution of definite concentration with a standard brine solution and electric current. Regulation of dosage is obtained by varying the quantity of this solution added.

Since, however, the quantity of hypolchlorite formed is proportional to the quantity of electric current passing through the "cell" as well as to the number of unit cells, it is possible to regulate the dosage by regulating the current and permitting a continuous flow of salt solution to pass through the "cell." The current may be regulated by varying the internal resistance of the cell, as by changing the concentration of the salt solution, or by varying the voltage applied, as by changing the external resistance in the circuit. By a suitable combination it is a simple matter to adjust these factors so that a definite dosage is applied, and to so calibrate a rheostat as to read directly in parts per million the quantity of available chlorine under any conditions of operation.

While the simplest practical application of this method lies in the disinfection of sea water used in purifying shellfish it may find application elsewhere.

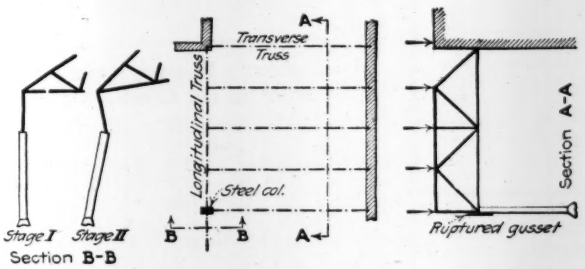
WILLIAM FIRTH WELLS,
Biologist and Sanitarian,
New York State Conservation Commission
Albany, N. Y., Dec. 27.

Column and Truss Bracing Blamed for Theater Roof Collapse

Sir—Defective design is suggested by the report on the Brooklyn theater collapse reported in your issue of Dec. 8, p. 954. The sketches herewith indicate a type of structural design which may or may not have been incorporated in the actual structure (and even if the structure was designed as indicated it would not necessarily prove that the failure occurred in the manner here suggested); but they convey a valuable lesson in structural steel design and for this reason they are brought to attention.

Assume a case where, as in the Brooklyn theater, the ends of certain transverse trusses are carried on a longitudinal truss, one end of which rests on a column. Section AA shows the column properly braced in one direction, but Section BB, Stage 1, shows that it has no bracing at its top in the other. Here we have a condition of unstable equilibrium, and a result as shown for Stage 2 is possible.

The writer feels that in any such case as this the column should be extended to the top chord of the transverse



UNBRACED COLUMN IN BROOKLYN THEATER

truss. Nearly all structural steel failures in the past have been due to lack of proper bracing and in looking for the cause of a failure in structural steel, to borrow a famous expression of detectives, *cherchez* the missing braces. It is to be hoped that the cause of the Brooklyn theater failure will be definitely determined because it will doubtless prove an invaluable lesson.

A number of questions occur to one looking over this design. There is no erection bracing provided. The purlins which are used to brace the top chord should, according to present ideas of structural design, provide ample bracing for this chord. Yet the method is not altogether positive. The question of the strength of the brick piers has been raised. Such pier construction is used largely in theater work, and practice would seem to indicate that it is safe. The piers are very large in proportion to their load, and as they are used to provide stiffness in the wall they probably are so excessive in area that it is inconceivable that they failed under the light truss load unless the bearing plates and trusses were inadequate.

The form of the transverse truss is a peculiar one in that it is a combination of a collar beam and trussed rafters and induces in addition to its direct stress certain compression stresses and flexural stress which make the analysis rather complicated, and might easily lead one to suspect in case of a failure that the design had not been properly made.

To my mind there is however, according to the sketches contained in your report, only one outstanding incorrect point of design, namely the fact that the steel column was not properly braced at the top in one direction.

ELWYN E. SEELYE,
New York, Dec. 12. Consulting Engineer.

Sir—The case of the theater building in Brooklyn the collapse of which you describe in your issue of Dec. 8 is another example of faulty design.

The great fault in this design is one piece with practically all large steel failures. It is the omission of bracing. The long row of roof trusses, so far as the report of the failure shows, and so far as the photographs show, had not a wire nor a rod of lateral or sway bracing. The most natural thing in the world for these trusses to do was to fall over. It is only by a freak of nature that they stood up as long as they did.

Besides having no diagonal bracing of any kind to hold the peaks of these trusses in line there was not an opportunity to tie the roof to the end wall, for, by the photographs, this wall was not yet built above the level of the bottom chords of the trusses.

Naturally the pilasters on which the trusses rested would be messed up a bit by the collapse of the trusses. Also the column supporting the longitudinal truss would be jarred. The trusses as they lie with top chords flopped over all in one direction are sufficient index of the history of the collapse.

Not long ago I checked the design of a building which was without bracing. I recommended that bracing be added. The builder's engineer persuaded the owner that this was unnecessary. But when they came to erect the building, it was found impossible to line it up. Struts and rods were hurried to the site by express.

EDWARD GODFREY.
Pittsburgh, Dec. 13.

Limestone Crusher Dust and Poor Concrete

Sir—The account in *Engineering News-Record*, Dec. 8, 1921, p. 934, of the failure of concrete building in which the aggregate was limestone with a considerable percentage of crusher dust, reminds me that two experiences of this kind have come to my personal attention.

The first case was that of some concrete piers for a steel truss bridge over the Kankakee River in Indiana. After a lapse of about one year, the concrete of these piers was still soft and samples could be taken out with a heavy trowel. The remains of the pile of aggregate showed the concrete had been made with soft limestone containing crusher dust. The coping on the abutment, which was made with sand aggregate, was hard and firm. The concrete in the piers of a railroad bridge over the Kankakee River very near the highway bridge was in good condition. Samples of the aggregate containing different percentages of crusher dust were taken to the laboratory and made into the usual tension and compression specimens. These under test showed a high strength.

When the soldiers were being taught the art of concreting at Purdue University during the war, they had two short sections of retaining wall to build, (a) with sand and gravel aggregate, and (b) with soft limestone aggregate containing unusual proportions of crusher dust. In both cases the cement, weather conditions, workmanship, amount of water, etc., were the same. Section (a) is excellent concrete; section (b) has not hardened and samples can be taken out with a stiff trowel. Laboratory investigations fail to produce data which would be predictive of the condition of this concrete which cannot be charged to "balling-up." The entire wall (b) is of the same character.

I am reminded that tests of reinforced-concrete beams containing crusher dust made at Purdue University in 1901 showed excellent strength.

I have put this problem up to expert cement chemists without an answer. It would appear that the use of soft limestone aggregate with crusher dust is attended with grave dangers.

W. K. HATT,
Washington, D. C., Director, Advisory Board
Dec. 27. of Highway Research.

NEWS OF THE WEEK

New York, January 5, 1922

Program for Annual Meeting of Am. Soc. C. E.

Conference on National Transportation Problems Will Be Feature—Dinner Dance Announced

The sixty-ninth annual meeting of the American Society of Civil Engineers will be called to order by President George S. Webster in the Auditorium of the Engineering Societies Building, New York City, at 10 a. m., Jan. 18. The usual business coming before the society at its annual meetings will be transacted at this session. The rest of the program is as follows:

Luncheon at McGraw-Hill Building.—Through the courtesy of E. J. Mehren, Editor, *Engineering News-Record*, luncheon will be served to members only at 1 p. m. Jan. 18, by the McGraw-Hill Co. at its building 10th Ave. at 36th St. After luncheon, this, the largest plant for the printing of technical magazines in the United States, will be open to inspection. Motor buses will be provided to transport those in attendance from the Engineering Societies Building, to the McGraw-Hill Building.

Reception and Dinner Dance.—The President's and Honorary Members' Reception, starting at 7.30 p. m., Jan. 18 and followed by a dinner dance, will be held in the ball room of the Pennsylvania Hotel, 7th Ave. at 33d St.

TO DISCUSS TRANSPORTATION

On Jan. 19 a conference on National Transportation Problems will be held in the auditorium of the Engineering Societies Building.

9.30 a. m.—The morning session will be confined to Water Transportation.

12.30 p. m.—Luncheon will be served by the society to members, ladies, and guests on the fifth floor of the Engineering Societies Building.

2 p. m.—The afternoon session will be confined to Railroad Transportation.

For those who do not care to attend the Transportation Conference excursions have been arranged to the New York Stock Exchange, Federal Reserve Bank Building foundations, American Bank Note Co., and the Hell Gate power station.

The smoker at 8.30 p. m. Jan. 19 will be addressed by a speaker of national prominence.

The conference on National Transportation Problems will be continued at three sessions on Jan. 20 and will be devoted exclusively to the subject of Highway Transportation.

Clarence A. Bingham Chosen City Manager of Lima, Ohio

Clarence A. Bingham, who has been successively city manager of Norwood Waltham, Mass., and Watertown, N. Y., has been chosen manager of Lima, Ohio, effective Jan. 1, when the new commission-manager charter goes into effect. Mr. Bingham was selected from about forty men who were considered for the position. His salary will be $8,000 a year.

Great Northern Considers Double Tracking Project

The Great Northern Railway in Spokane is considering the double tracking of its line between Wenatchee and Harrington, a distance of approximately 35 miles, at a cost of something over $700,000, or $20,000 a mile. If the work is approved, construction will begin early in March.

New Standardization Work

Uniform methods of testing wood are to be developed by a committee organized under the general direction of the American Engineering Standards Committee; The American Society for Testing Materials and the U. S. Forest Service are joint sponsors for the work. Railroad tie specifications are to be unified by a committee under sponsorship of the Forest Service and the American Railway Engineering Association. The field covered is to include grouping of ties with respect to treatment, and inspection rules, but not methods of treatment.

By direction of the Secretary of War the supply branches of the army will hereafter utilize in connection with their specifications the standards adopted by the American Engineering Standards Committee.

Chicago Building Deadlock Seems Probable

Pledges to support the carpenters' union in Chicago by refusing to work on jobs under the Landis award or on open shop jobs have been made by all unions affiliated with the Building Trades Council. This resolution, passed Dec. 30, means in effect another building deadlock as the unions propose to call out workers on jobs where non-union men are employed.

The Citizens' Committee to Enforce the Landis Award has announced that outside plumbing contractors will be brought into Chicago to operate under the terms of the award. The master plumbers refused to "go along," and that trade is "open shop" from now on as well as the sheet metal trades which had previously been declared open shop by the committee.

The finance committee of the City Council, in making up the 1922 budget, declared in favor of applying the Landis award in city payrolls. An estimated annual saving of $300,000 in the water department will be effected thereby.

Advertisements in 19 cities of the Central West for sheet metal workers has brought in 200 applicants by the first mail ready to work on the open shop basis.

On recommendation of the public affairs committee the board of directors of the Western Society of Engineers has endorsed the Landis award and pledges its full support to the program of the citizens' committee.

New York Water Power Body Issues First Permits

The New York Water Power Commission on Dec. 31 issued preliminary permits to the Louisville Power Corp. for the development of water power in the St. Lawrence River near Croil Island, and to the St. Lawrence Transmission Co. for a like purpose on the St. Lawrence River at Long Sault Rapids. These applications are the first to receive favorable consideration by the commission.

These permits do not authorize power developments but enable these companies to make examinations, surveys, plans, and estimates and to file them with the Water Power Commission with an application for a license to develop the water powers at the point mentioned, upon such rental as the Commission may then determine to be equitable. The action of the commission upon these applications is an assertion of the rights of the State of New York in the power to be developed on the St. Lawrence River for the benefit of the people of the State of New York.

Preliminary Report Made on City Plan for Cincinnati

A preliminary report on city planning for Cincinnati, described as not a plan but a basis for such a plan, has been submitted to the City Planning Commission by the Technical Advisory Corporation of New York City, after four months of study. A year's further study of the various problems confronting the city is advised before detailed planning is undertaken. General suggestions are made, however, for: two new railroad stations; terminals; changes in downtown traffic; street widening; change single trolley in place of the present double trolley system; electric railway track standardization for the benefit of interurban lines; a housing corporation; flood prevention work. An appropriation of about $105,000 to pay experts for some three years of comprehensive planning work is also suggested.

Philadelphia Takes Over Balance of Street Cleaning Work

The change from the contract to the direct city system of street cleaning and the collection and disposal of garbage, ashes and rubbish, begun last year by Philadelphia, was made complete with the beginning of 1922. The service is being performed by the Department of Public Works, Frank H. Caven, director, and is directly in charge of the Bureau of Highways, of which Fred C. Dunlap is chief, with John H. Neeson deputy chief in charge of street cleaning and E. D. Very as engineer. More details appeared in *Engineering News-Record* Jan. 27, 1921, and portions of a report on the subject by a special commission were printed in the same journal for July 29 and Aug. 19, 1920, pp. 236 and 357.

Road Program Costing $34,000,000 Planned for South Carolina

Contractors are taking much interest in the plan proposed by Governor Cooper for the expenditure of $34,000,000 in South Carolina in a six-year road building program. The money is to be raised without adding to the present property tax in the state and will be submitted to the legislature which meets this month. The plan, if put into effect, will give South Carolina 4,000 miles of improved roads, 600 miles of which will be hard surfaced.

Governor Cooper in his plan suggests the following means of raising $34,000,000: Federal-aid for six years, $6,600,000; an increase in the automobile license fees so as to bring in $1,300,000 a year or $7,800,000 in six years; approximately $6,200,000 from the 2-mill property tax already effective; approximately $3,400,000 from a gasoline tax imposed for six years at 1c. per gallon; a state bond issue of $10,000,000.

A number of bridge projects are provided for under the proposed program.

Akron Engineering Societies Approve City Zoning

The tentative zoning plan for Akron, Ohio, submitted in printed form in October, was outlined before the Engineering Society of Akron on Dec. 13 by Charles F. Fisher, planning engineer of the Akron Planning Commission. The society adopted a resolution approving the principle of zoning and providing for the appointment of a committee with power to study the proposed zoning scheme and transmit its finding directly to the City Planning Commission and to the City Council as the action of the society. On Dec. 18 the Akron Chapter of the American Association of Engineers approved zoning and the tentative plan. A committee of the association is preparing a report on the subject.

Condemnation Rights Involved in Seattle Reservoir Case

In the re-hearing Dec. 9 before the State Supreme Court at Olympia, Wash., of the City of Seattle's injunction suit to obtain permission to proceed with the construction of the proposed reservoir in Volunteer Park, assistant corporation counsel argued that the city, under its charter, has the right of condemnation of any piece of property within the corporate limits. A departmental decision of the Supreme Court Aug. 29, 1921, favored the city, and the 83 property owners who are opposing the proposed reservoir, were granted a rehearing enbanc.

At the rehearing, the city presented photographs and maps to show that none of the beauty spots in the park would be damaged by the proposed reservoir, and introduced evidence to show that it would cost the city $443,000 more to construct the reservoir where the residents want it, north of the park, than on the proposed site in the park.

Attorneys for the residents argued that condemnation is not authorized by the city charter, that the reservoir would constitute a menace to adjoining property, and that would infringe upon the rights of the public to enjoy the parks. An early decision is expected.

New Water Supply for Phoenix

The gravity water supply for the City of Phoenix, Arizona, was put into commission Dec. 15 by turning the waters of the Verde River into the completed system. Prior to this the supply had been obtained from driven wells within the corporate limits of the city. This improvement has cost $1,925,000.

Uncompleted Concrete Arch Bridge Collapses

Two spans of a concrete arch bridge under construction over Lake Worth, between Palm Beach and West Palm Beach, Fla., collapsed on the afternoon of Dec. 29, and a third arch fell on the following day. The concrete structure was practically complete at the time of the accident, but spandrel filling was being placed. This consisted of lake bottom sand, pumped in by hydraulic dredge. It was intended to open the bridge for temporary traffic service during the winter within a few days.

While official detailed information on the conditions existing at the time of the collapse is not yet available, the superintendent for the contractor, the A. S. Hecker Co., of Cleveland, is reported by the Palm Beach *Post* to have stated that the arch barrels were a minimium of 26 days old, that a steam roller had been at work on the fill, and that while this rolling was in progress he heard a cracking noise, the collapse occurring soon after. Harrington, Howard & Ash, Kansas City, consulting engineers and designers of the bridge, advise *Engineering News-Record* that the failure probably resulted from unbalanced loading of the arches by the hydraulic-dredge spandrel filling. The work is under general direction of R. S. Goodman, county engineer, but the construction was supervised by the consulting engineers.

W. Va. Engineers Must Register

According to the act regulating the practice of professional engineering, which became effective July 27, 1921, it will be unlawful to practice in West Virginia as a "registered professional engineer" after Jan. 27, 1922, unless such engineers are duly licensed. Registration is not compulsory except for those desiring to use the title "registered professional engineer."

Lord Ashfield Advocates Motor Roads Underground

(London Correspondence)

According to Lord Ashfield, chairman of the London Traffic Combine, Britain should have 3,500,000 motor vehicles instead of the existing 870,000, so as to bring up the number of persons per vehicle to the same level as that obtaining in the United States. Even now, all roads are inadequate to carry existing traffic, and wide motor roads, he believes, should be constructed parallel with the railroads so as to effect closer co-operation and the solution of the transit problem. Lord Ashfield also emphasizes the necessity for more subways throughout the country, and also the construction of underground roads near London for motor traffic.

War Department Announces Policy on San Francisco Bay Crossing

No decision has been reached by the War Department as to which of the sixteen proposals for the construction of a crossing across San Francisco Bay it may approve. The Chief of Engineers has announced the broad policy which must govern this construction, as follows:

1. No bridge of any kind will be approved north of Hunters Point.
2. No low bridge will be approved north of San Mateo.
3. A tunnel crossing the bay will be approved in any location provided the highest part of the structure is placed at least 50 ft. below mean low water and proper compensation is made for obstruction of cross-section as affecting tidal flow.
4. A combined bridge and tunnel will be approved at a location south of the proposed Alameda River base site, provided the tunnel is so placed as to leave the channel along the San Francisco side unobstructed to a depth of 50 ft. at mean low water for a width of one mile (the width of the unobstructed 50-ft. channel immediately outside the pierhead line may be reduced to 3,000 ft.) measured from the lowest point of the pierhead line, and provided proper compensation is made for obstruction of the cross-section as affecting tidal flow.
5. Not more than one crossing will be approved at present in any location north of San Mateo.

Roads Bureau Calls for Maps of Federal-Aid Highway Systems

Th U. S. Bureau of Public Roads has urged each of the state highway commissions to expedite the preparation of the maps showing the highway systems on which federal-aid funds are to be expended. Among the instructions to be followed by the states in the preparation of these maps are the following:

1. The primary system shall be shown by two parallel black lines ⅛ in. apart.
2. The secondary system shall be shown by two parallel dash black lines ⅛ in. apart.
3. In a table upon the map shall be shown the total highway mileage of the state, total mileage of the federal-aid highway system, and the mileage in the primary and secondary systems, respectively. (The federal-aid highway system shall be not more than 7 per cent of the total highway mileage.)
4. The whole system and each of the primary and secondary divisions shall be respectively continuous and correlating.
5. Supplementary maps on a large scale should be prepared to accompany the federal-aid highway system maps showing terminals in cities.

Syracuse To Have New Conduit

With the completion of a third conduit about 50,000,000 gal. of water will be brought into Syracuse, N. Y., daily from Lake Skaneateles. The two present conduits have an estimated combined daily capacity of 27,000,000 gal. and completion of the third will nearly double this.

The new conduit is to be 36 in. in diameter and will be approximately 12 miles in length. Only 6 miles of the conduit will be laid this year.

New York City Finally Shortens Chelsea Piers

Just before retiring as commissioner of docks and ferries of the City of New York, Murray Hulbert signed a contract to shorten by 100 ft. the two Chelsea piers which have been a subject of contention between the city of New York and the United States War Department for about a year. The piers were extended under the plea of temporary necessity some years ago, but the City of New York has been endeavoring to make the extension permanent. Successive Secretaries of War have been firm in their insistence that the city should reduce the length of the piers to the dimensions required for a safe navigation of the Hudson at this point. The city finally, following orders of the Secretary of War to the Chief of Engineers to shorten the piers himself, agreed to do the work.

U. of P. Announces Short Highway Course

The brief course in highway Engineering given last year by the civil engineering department of the University of Pennsylvania is to be repeated. This year's sessions, under the general direction of Director Milo S. Ketchum, will begin Jan. 23 and end Feb. 8. Conferences on important highway engineering subjects will be arranged for Feb. 9 and 10. Several evening lectures will be given by eminent specialists.

In addition to the courses given during the first session, courses will be given in the maintenance of highways, in contracts and specifications, and the duties of the inspector. Instruction in laboratory and class-room will for the most part be in charge of practising engineers who have had a large experience in the design and construction of highways.

Among the non-resident instructors are the following: H. E. Hilts, principal assistant engineer; W. A. Van Duzer, assistant maintenance engineer; W. R. Wolfinger, assistant construction engineer; Malcolm H. Ulman, chemist, and H. S. Mattimore, engineer of tests, Pennsylvania State Highway Department; Julius Adler, deputy chief, Bureau of Highways, Philadelphia; William C. Perkins, chief engineer, Eastern Paving Brick Manufacturers' Association; D. S. MacBride, Portland Cement Association; Charles H. Clifton, City Testing Laboratory, Philadelphia.

Fall River Lets Garbage Collection and Disposal Contract

A 5-year contract for the collection and disposal of the garbage of Fall River, Mass., has been awarded by the Board of Health (Samuel B. Morris, agent) to Edward J. Dunn of that city for $79,000 for the whole period. Four other bids ranged from $48,000 to $175,000, but the board questioned the possibility of doing the work at the lowest figure, and the next lowest bidder was not anxious for the work. A. H. Barney, Providence, R. I., and W. C. Gardner, the latter holding the present 5-year contract at $39,000, expiring late in January, bid $95,000. The new contractor will dispose of the garbage on a 30-acre farm in Westport. The contractor must make collections throughout the entire city three times a week in June, July, August and September, and twice a week the rest of the year.

Urge Sale of Spruce Railroad

The Seattle (Wash.) Chamber of Commerce, has joined with the Port Angeles Commercial Club in asking that the Secretary of War direct the Spruce Production Corp. to offer at public sale to the highest bidder the government's spruce railroad No. 1, consisting of 36 miles of standard gage railroad in Clallam County, the government sawmill and its machinery, with timber lands purchased in connection therewith, without stipulating any minimum price. The operation of the spruce railroad, it is urged, would permit of saving billions of feet of valuable logs blown down in the great storm of January, 1921, which otherwise must become a total loss.

Boston's Mayor-Elect Fails To Hold Up Garbage Contract

The application of Mayor-elect Curley of Boston for a court order to prevent the City Council and the out-going mayor from executing a contract for garbage disposal for the ten years beginning July 1 next has been denied by a judge of the Massachusetts Supreme Court, and the contract was awarded on Dec. 28 to Coleman Bros. at a total of $3,795,000 for ten years. The judge held that the award was a matter of discretion and judgment rather than of law and characterized the claim of fraud as "the hurling of an epithet." Details of the request for bids, the bids themselves and the recommendations of a special committee, the commissioner of public works and the mayor that the contract be awarded to Coleman Bros. were published in *Engineering News-Record* for July 14, 1921, p. 82, Sept. 15, p. 465, and Nov. 10, p. 788, respectively. The bids were received Sept. 26 but the City Council did not begin hearings on the subject until Nov. 16.

Short Highway Course Planned for Tennessee Engineers

The University of Tennessee, with the co-operation of the Tennessee Highway Department, will offer a six weeks' highway course at the university, at Knoxville, beginning Jan. 9 and ending Feb. 17. The instruction includes, mathematics, mechanics, drawing, elementary surveying, testing of materials, highway engineering and economics, specification writing, and motor mechanics. This will be supplemented by special lectures. The faculty will consist of professors and instructors from the university's engineering department, engineers of the state highway department, U. S. Bureau of Public Roads and from engineering firms and sales organizations.

Minnesota Plans Winter Highway Work

Minnesota has planned a program of winter highway work which will provide jobs for 8,500 men. Charles M. Babcock, state highway commissioner states that, "Competition is keen for winter contracts and half of Minnesota's program has been contracted for at 1917 prices." An outlay of $2,500,000 calls for gravel surfacing, distribution of materials, rock crushing and heavy excavation. The work as planned includes 300 miles of graveling, 50 miles of grading and 50 miles of paving.

St. Paul Voters Hold to Commission Plan City Charter

At an election on Dec. 29 the voters of St. Paul, Minn., defeated the proposed change from the present commission plan of city government to the federal or mayor-and-council plan, outlined in *Engineering News-Record* Nov. 10, 1921, p. 783. The vote stood 16,123 for to 21,549 against.

Wood Preservation Convention at Chicago in January

The 18th annual meeting of the American Wood Preservers' Association will be held at the Sherman Hotel, Chicago, Jan. 24-26. The subjects include the preservative treatment of wood for piles, ties, structural and mine timbers, cars and pipe; also papers on the layout and operation of treating plants.

Among the papers listed are the following: "Effect of Heat on Wood Destroying Fungi in Mills," Dr. W. H. Snell; "A Theory of the Mechanism of Wood Protection by Preservatives," Ernest Bateman; "Economics of Tie Renewals," V. K. Hendricks; "Factors Affecting the Cost of Treated Ties," E. E. Pershall; "Should the Cost of Treated Ties be Charged to Maintenance or Capital Account?" Earl Stimson; "Tropical Hardwoods for Ties in This Country," Nelson C. Brown; "Creosoted Wood Stave Pipe," H. I. Coale; "Preservation of Mine Timbers," R. R. Horner; Report on Piling in San Francisco Bay, F. D. Mattos; "Report on Piling on the Gulf Coast," E. E. Boehne.

New York City Awards Stapleton Pier Crane Contract

On Dec. 30, the City of New York awarded the contract for the freight-handling cranes for the new shipping piers at Stapleton, S. I., to the Wellman-Seaver-Morgan Corp., for the $324,500 bid on alternate (a) in the tenders. A history of the case, which includes a re-advertising for bids because of charges of irregularities in the low bid, was given in *Engineering News-Record* Dec. 8, 1921, p. 954, and the latest bids were recorded in the Construction News Section of the issue of Dec. 29, 1921, p. 287. The successful bidder's bid in the earlier opening was $396,435 and the contested bid of Heyl & Patterson, Inc., was $370,882, both for alternate (a). The latter company bid $344,921 on the re-advertised tenders.

Dallas Considers $5,000,000 Dam and Water Supply Project

A lake impounding 104,000,000,000 gal. of water is being proposed for Dallas. The site, surveyed last winter by Major W. J. Powell, engineer for the Supervisor of Public Utilities, was visited last week by the Board of City Commissioners for the purpose of determining the feasibility of the project.

This site which is one of four located by Major Powell last winter is at a narrow gorge on Denton Creek, 20 miles northwest of Dallas and of sufficient elevation above Dallas to permit of a gravity flow into the city using the natural river bed for this purpose. The maximum height of the dam would be 105 ft. and the cost of the entire project as at present estimated is $5,000,000.

Idaho Will Examine Applicants for Engineer Licenses

An examination to determine the fitness of applicants for civil engineers and surveyors licenses will be held in the office of the Bureau of License, Boise, Idaho, May 14 and Sept. 12, 1922. Information and application blanks may be obtained from Paul Davis, director of the bureau.

Begin Work on East Approach of Castleton Bridge

Work has been started by the Walsh Construction Co. on building six piers for the east approach of the Castleton Bridge over the Hudson River at Castleton, N. Y. These piers will carry a plate-girder super-structure. The main structure, which will cross the navigable channel of the Hudson by a 600-ft. span with a 400-ft. flanking span, is the principal structure of a cut-off line enabling through traffic to avoid the track congestion and severe grades of the main line through Albany.

Annual Meeting of the New England Water Works Association

The annual meeting of the New England Water Works Association will be held as required by the constitution on Wednesday, Jan. 11, at 2 p.m., at the rooms of the association, Tremont Temple, Boston. No arrangements have been made to provide a program for this date. The meeting will be adjourned to Thursday, Jan. 12 at 1 p.m. in the Boston City Club, the change in date having been made because rooms at the City Club were not available on Jan. 11. The regular program will be carried through at the meeting on Thursday, Jan. 12.

Indiana Reports Road Costs

The Indiana highway commission expended $3,439,926.12 for the construction of new roads in the state during the fiscal year ending Sept. 30, the annual financial report of John D. Williams, chief clerk of the department, shows. During the same period the commission disbursed $4,377,243.84 for road maintenance. Total expenditures for the year amounted to $8,166,121.94. The report was prepared under the supervision of Lawrence Lyons, director of the commission.

The total cost of supervision of all work by the commission was $234,855.20 or 2.87 per cent of the total expenditures and 3.16 per cent of the expenditures for construction and road maintenance.

Bar to Tri-City Sewage-Works Raised by County

Progress on the proposed tri-city sewage-works project for Pasadena, South Pasadena and Alhambra, Cal., may be expected soon, now that the Los Angeles County supervisors have given up their proposed ordinance designed to prevent the use of sewage farms anywhere in the county. The supervisors have approved a site for sewage-works on land now owned and used by Pasadena as a sewage farm. According to R. V. Orbison, city manager of South Pasadena and formerly city engineer of Pasedena, elections to vote on sewage disposal bonds will probably be held soon.

San Francisco Bay Bridge Project To Be Discussed Jan. 10

The general bridge committee comprising city and county officials from various parts of the San Francisco bay region will hold a meeting in Oakland Jan. 10 to discuss the announcement of the war department on the proposed San Francisco Bay bridge (reported in *Engineering News-Record* Dec. 29, p. 1080) and to consider further action. The first step is to be the raising of $150,000 needed for preliminary surveys, although it is reported that at this meeting plans for financing the construction of the bridge itself will be considered.

Richard J. Welch, member board of supervisors, San Francisco, is chairman of the general bridge committee.

Quality of Cement Basis of Association Membership

Amendment to the constitution of the Portland Cement Association at its recent meeting makes membership "contingent upon members' product meeting the standard specifications for portland cement adopted by the U. S. Government and the American Society for Testing Material."

The following officers were re-elected: President, L. T. Sunderland; vice presidents, Richard Hardy and S. B. Newberry; Treasurer, F. W. Kelly. The new directors are as follows: H. Struckman, Charles F. Conn, H. L. Block, W. M. Hatch, George T. Cameron and David M. Kerk.

Want Part of Motor Fees for City Pavement Maintenance

The municipal legislative program, submitted to the Governor and the Legislature of the State of New York by the New York State conference of mayors and other city officials, recommends that the legislature, at the next session, enact laws that will give to the cities of the state their share of the moneys received from automobile fees that the same be used for the upkeep of their streets and bridges which are used as connecting highways. The present laws regulate the weight of auto trucks outside the limits of the cities; it is the recommendation that the legislature regulate the weight in the city limits to protect the pavements. The method in vogue at present is for the cities to regulate by city ordinance.

Traffic Handling Is Topic of Am.Soc.C.E. Discussion

Traffic handling, its engineering as well as regulatory aspects, will be the main topic of discussion at the meeting, Jan. 11, in the Engineering Societies' Building, of the New York Section of the American Society of Civil Engineers. Two formal addresses will be made by E. P. Goodrich, consulting engineer, New York, and Amos Schaeffer, consulting engineer to the president of the Borough of Manhattan, New York. These papers will be followed by a discussion which will be participated in by Robert Grier Cooke, president, the Fifth Ave. Association; Dr. John A. Harriss, special deputy police commissioner; Clifford M. Holland, chief engineer, New York-New Jersey Tunnel Commissions; and A. T. Warner, traffic engineer, Public Service Railway Co., Newark, N. J.

El Paso Sells Bonds

A bond issue of the City of El Paso, Texas was sold Dec. 20 to Stern Bros. & Co., of Kansas City for ¼ of 1 per cent above par, with interest at 5 per cent on $1,850,000. This was estimated to be a saving of $100,000 for the city over a previous bid of 5¼ per cent.

Agricultural Engineers Meet in Chicago

Flood control, drainage and irrigation in relation to agriculture were among the subjects presented at the annual meeting of the American Society of Agricultural Engineers, held in Chicago, Dec. 27 to 29. Prominent among these hydraulic papers was one on "Flood Control in Agriculture," by Arthur E. Morgan, who discussed this subject with reference to the Miami Conservancy District in Ohio.

Farm buildings, their construction, sanitation and drainage, formed the subject of another group of papers, while a third group dealt with tractors and farm machinery. One session was devoted to college education in agricultural engineering.

The officers for 1922 are as follows: President, A. J. R. Curtis, Portland Cement Association, Chicago; vice-presidents, G. W. McCuen, Ohio State University, Columbus, Ohio, and David Weeks, Dakota Engineering Co., Mitchell, So. Dak.; secretary, Raymond Olney, St. Joseph, Mich.

ENGINEERING SOCIETIES

Calendar

Annual Meetings

AMERICAN CONCRETE INSTITUTE, Detroit, Mich.; Annual Convention, Cleveland, Ohio, Feb. 13-16.

AMERICAN ROAD BUILDERS ASSOCIATION, New York; Annual Convention and Good Roads Show, Chicago, Jan. 17-20.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York City; Annual Meeting, New York City, Jan. 18-20.

ASSOCIATED GENERAL CONTRACTORS OF AMERICA, Washington, D. C.; Annual Conference, Cleveland, Ohio, Jan. 17-19.

The San Francisco Engineers Club held a meeting on Dec. 15 to hear an address by J. B. Lippincott, consulting engineer of Los Angeles, on "Colorado River Hydro-electric Development." O. C. Merrill, executive secretary, federal power commission, also addressed the meeting. C. E. Grunsky, chairman of the meeting, reviewed briefly the early attempts to control the Colorado River and the present situation with regard to irrigation and power problems. The speakers had attended the federal hearing on Colorado River power projects held at San Diego Dec. 12 and reviewed the prospects for early development of power as indicated by statements and discussions at that meeting.

The County Highway Engineers' Association of Missouri will hold its fifteenth annual convention in Kansas City, Mo., Jan. 12-14.

The Trenton (N. J.) Engineers' Club has elected the following officers: Presi-

dent, Harry F. Harris; vice-president, Edward E. Reed; secretary, Joseph E. English; treasurer, James H. Johnson.

The American Society of Agricultural Engineers recently elected A. J. R. Curtis of Chicago, Ill., as its president for the coming year. Mr. Curtis has specialized in the development of farm buildings. Since graduation from Lewis Institute in 1909, he has been engaged in educational and farm promotive work. During the World War he was appointed inspector of government concrete schools. At the present time he is manager of the Cement Products Bureau of the Portland Cement Association in Chicago.

The Northwestern Section, Am. Soc. C. E., at its November luncheon meeting, elected the following officers: Chairman, Frank B. Sanborn; vice-chairman, Walter C. Voss; secretary-treasurer, Charles W. Banks; members of the executive committee, Leonard C. Wason and James H. Manning.

The American Wood Preservers' Association will hold its annual convention Jan. 24, 25 and 26 in Chicago.

The Engineers Subdivision, Chicago Association of Commerce, Dec. 21, elected the following officers for 1922: Chairman, Morris W. Lee; vice-chairman, Christopher Van Deventer. Other members of the executive committee are H. Boyd Brydon, James N. Hatch, William Lang, J. L. McConnell, Albert Newton, Robert Isham Randolph and C. C. Woodmansee.

The Toledo Chapter, A. A. E. has elected as president Joseph Hoffman, civil engineer and surveyor.

The County Highway Engineers' Association of Missouri will hold its 15th annual convention in Kansas City January 12, 13, 14.

The American Association of Engineers will hold its eighth annual convention in Salt Lake City, Utah, June 4-6.

The Washington Society of Engineers elected the following officers at its recent annual meeting: President, John S. Conway; vice-president, R. H. Dalgleish; secretary, A. C. Oliphant; treasurer, O. B. French.

The Providence Engineering Society will hold its annual dinner Jan. 31.

The San Francisco Section, Am. Soc. C. E., at its annual meeting Dec. 20 elected the following officers: President, Thomas H. Means; first vice-president, two-year term, Frank G. White; second vice-president, one-year term, G. A. Elliott. The members present at the meeting ratified the action of the board of directors in protesting to the Governor and to the director of the state bureau of engineering the sudden and summary removal of a capable engineer from the office of chief of division of water rights. The paper of the evening, presented by Charles Gilman Hyde, professor of sanitary engineering, University of California, was "The New Pumping and Filtration Works of the City of Sacramento, Cal."

The Kansas Section, Am. Soc. C. E. held its first meeting in the Chamber of Commerce, Topeka, Dec. 17, 1921. The president, L. E. Conrad, presided. In a short business meeting following the banquet, the section endorsed the adoption of an engineers' license law for Kansas and the president was appointed delegate to the meeting of the Kansas Engineering Society at Hutchinson with authority to discuss the law for the section. M. D. Downs gave a talk on city planning, referring particularly to the recent developments along that line in Topeka by the City Planning Board. M. W. Watson explained the details of recent federal-aid legislation, and reported in general on the road situation as expressed at the recent meeting of the American Association of Highway Officials at Omaha.

PERSONAL NOTES

ROLLEN J. WINDROW, state highway engineer of Texas during the past three years has tendered his resignation to the State Highway Commission to become the personal representative and advisor of Theodore Gary, chairman of the newly reorganized Missouri State Highway Commission and also to aid Mr. Gary, who is a capitalist, in his extensive private enterprises, among them being large telephone interests. As state highway engineer, Mr. Windrow received $10,000 per year until the last Legislature reduced this to $9,000, which included all traveling expenses, making him the highest paid official in the state. As advisor and assistant to Mr. Gary, Mr. Windrow is to receive an annual salary of $12,000 plus all traveling expenses and the cost of moving his family from Texas to Kansas City. Mr. Windrow is in no sense becoming the state highway engineer for Missouri, and no part of his salary is to be paid by that State. He is exclusively employed by Theodore Gary. For three years Mr. Windrow has been the Texas state highway engineer and before that served as a member of the State Board of Water Engineers and also as county engineer for McLennan County, his home being in Waco. He is a graduate civil engineer from the Texas A. & M., class of 1906.

C. J. ULLRICH has been appointed chairman of the local committee to make preparations for the National Convention of the American Association of Engineers to be held at the Hotel Utah, Salt Lake City, June 5, 6 and 7, 1922.

COL. CHARLES E. STANTON, U. S. A., retired, has been appointed commissioner of public works of San Francisco, Cal.

THOMAS H. MATHER, recently supervising engineer, U. S. Army Reserve Depot, New Cumberland, Pa., has been appointed city engineer of Syracuse, N. Y., to succeed Henry Allen.

WALTER W. MCGUIRE, formerly with the General Motors Corp. and the Water Division of St. Louis, is now secretary of the Chamber of Commerce at Carrollton, Mo.

DAVID R. DIEHL, an engineer employed by the New York Central R.R. in Cleveland, has been chosen city manager of Westerville, Ohio.

E. S. BORGQUIST, former district engineer with the Utah State Road Commission, has accepted a position with the Kittitas Reclamation District at Ellensburg, Wash. The engineering work is being done in co-operation with the U. S. Reclamation Service as a unit of the Yakima Project.

R. F. KELKER, JR., M. M. GATES and C. E. DE LEUW have dissolved partnership. The new firm of Kelker & De Leuw will engage in general municipal and sanitary engineering in Chicago.

HERRING & SCHELLHOUS, engineers of Forest City, Ark., have dissolved partnership. Mr. Herring will continue the practice of engineering in Forest City.

JAMES J. WALSH, for 21 years associated with the late Howard C. Holmes, will conduct the business as his successor under the name of Howard C. Holmes Co., specializing in harbor and municipal engineering in San Francisco.

WILLIAM A. SCHMIDT, building contractor, Johnstown, Pa., has been appointed street commissioner to fill the vacancy caused by the death of John Kammer.

T. M. JASPER, assistant professor of mechanics, University of Wisconsin, has been placed in charge of tests on the joint investigation of the fatigue of metals being carried on at the engineering experiment station, University of Illinois, in conjunction with the National Research Council and Engineering Foundation. PROF. J. B. KOMMERS, formerly engineer of tests, returns to the University of Wisconsin.

OBITUARY

GEORGE A. STACY, superintendent of the Marlboro, Mass., water and sewer department and former president of the New England Water Works Association, died at his home in Marlboro, Dec. 22.

HOWARD M. CHERRY, formerly with the Keystone Bridge Co., of Pennsylvania, died Dec. 21 at his home in San Diego, Cal. He had served 12 years as a member of the board of supervisors of San Diego and one term as county auditor.

HIRAM PHILLIPS, of St. Louis, Mo., who was employed as consulting engineer on the new Verde River water system for the city of Phoenix, Ariz., was instantly killed Dec. 22 in an automobile accident. L. B. Hitchcock, city engineer of Phoenix, accompanied Mr. Phillips on the trip, the purpose of which was a final inspection of the new system before the water from the Verde River was turned into the city's mains. Mr. Phillips was a former president of the St. Louis board of public improvements.

BUSINESS NOTES

THE COMBUSTION ENGINEERING CORP., New York City, announces the opening of a branch office in Pittsburgh. W. C. Stripe, formerly manager of the Philadelphia office, will be in charge.

F. S. SLATER, for several years with Detroit Graphite Co., has resigned to take position with the M. B. Suydam Co., paint manufacturer, Pittsburgh, in its New York office as Eastern sales manager.

Business Side of Construction

Facts and Events that Affect Cost and Volume

Labor Rates and Conditions Throughout the County

Citizens' Committee Enforcing Landis Award in Chicago—Heavy Cuts in St. Louis, San Francisco

It seems probable that the building crafts are most resistant to wage decreases. The chart in the labor review in the forepart of this issue shows that the average shrinkage of wage rates for skilled construction labor has been slight. Common labor, on the other hand, has been reduced an average of 25 per cent over the country. Wage reductions in factories range from 10 to 25 per cent, 20 per cent in the steel industry, 22½ per cent in the textile industries according to United States Bureau of Labor Statistics.

Current conditions in cities reporting to *Engineering News-Record* are as follows:

Los Angeles—Few men idle in the skilled building trades. Concrete workers and pick-and-shovel men receive $4.50@$5 per day. Common unskilled labor receives on the average 50c. per hour and represents the highest percentage of the unemployed. Piledrivers are reported as receiving as high as $1, but the average rate is 87½c.

Cincinnati—Bricklayers on strike, but wage adjustment expected soon.

Denver—Unemployment on the increase and all new work at a standstill as a result of cold weather. An unusually open winter, however, favored building operations until the middle of December.

Baltimore—No labor troubles. Hoisting engineers receive 87½c.; hodcarriers 54c.; piledrivers 74c. and common labor 30c.

St. Louis—Hoisting engineers quoted as low as $1.25 as against the regular rate of $1.37½; hodcarriers 85c.@87½c.; common labor 62½c.@67½c. The building contractors' proposal of a 20 per cent wage reduction from the standard rate of $1.25 per hr., was rejected by about 3,000 carpenters. In East St. Louis common labor on highway work is paid from 25c. to 35c. per hr.

New Orleans—Building trades mechanics are working below the standard pay scale in order to obtain employment. The scramble for contracts on public schools for 1922, indicates the construction stagnation here.

Seattle—Building activities in the Puget Sound district are subject to the usual seasonal restrictions and many prospective builders appear to be holding off until the new year is farther advanced, when it is believed building on a larger scale will be resumed. Architects are crowded with prospective work, including several business blocks, one or more hotels, apartments, residences and small industrial plants. The unemployment situation is unimproved, 8,000 to 10,000 men being idle. Recent floods and high water have hampered construction.

Boston—Carpenters receive 75c.; common labor 40c.@50c. per hour.

Detroit—Official rates unchanged, but some contractors are paying less than the established rates. Few new construction projects are being started to take care of labor being released by projects just completed. A number of bricklayers are reported by the Associated Building Employers to have left Detroit for other cities in Michigan, where schools and public buildings are under contract.

Philadelphia — Few changes in the current building trade's wage schedule are expected in the near future. The Builders' Exchange and Employers' Association has stated that conditions in the construction industry are now stable. Reasonable wage rates, increased efficiency and lower material costs have made this condition possible.

Minneapolis—Common labor is being obtained generally at 40c.@50c., though the city is still paying by ordinance, $5 per 8-hour day. This rate is about 50 per cent above that paid outside of municipal work. Considerable unemployment.

Pittsburgh — The Master Builders Association of Allegheny County and the Carpenters District Council of Pittsburgh and vicinity have signed an agreement until Feb. 28, 1923, in which all disputes between carpenters and employers are amicably settled, the existing scale to remain in force.

Spokane—Organizations of all kinds have united to establish a labor clearing house where all men and women in need of employment are expected to register. Preference is given to citizens of Spokane. Renewal of mining operations and greater demands for northwest lumber are expected to improve conditions.

Chicago—The Landis decision, which reduced bricklayers from $1.25 to $1.10, carpenters from $1.25 to $1, structural ironworkers from $1.25 to $1.05, pick-and-shovel men from $1 to 72½c., and placed hoisting engineers at $1.10, as well as effecting other changes in the wage schedule, is being rigidly enforced

Engineering News-Record Construction Cost Index Number

January, 1922	**168.72**
December, 1921	167.82
January, 1921	230.87
Peak, June, 1920	273.80
1913	100.00

Engineering News-Record's Construction Cost Index Number is .9 points higher than last month owing to a stronger lumber market; pine in New York is $1.50 higher than a month ago. Structural shapes in large quantities can still be bought for $1.50 per 100 lb. The average labor rate for the country this month is 45c., the same as last. Thus, general construction cost is 26 per cent cheaper than one year ago and 38 per cent under the peak; it is 69 per cent above the 1913 level.

Engineering News-Record Construction Volume Index Number

Monthly	
December, 1921	**118.00**
November, 1921	101.00
December, 1920	60.00
1913	100.00
Yearly	
1921 (entire year)	88.00
1920 (entire year)	91.00
1913	100.00

Engineering News-Record's Construction Volume Index Number is 118 for the month of December, and 88 for the whole of 1921, as against 100 for 1913. This means that the actual volume of construction in 1921 (not the mere money value of the contracts let this year) is 13 per cent under the volume of construction for 1913. Our monthly volume number, 118 for December, 1921, is really the increment of construction, and indicates the rate at which contracts are being let as compared with 1913 awards.

Important features of the

BUSINESS SIDE OF CONSTRUCTION

will be found on pages 8 to 13 of this issue, as follows:

Spring Prices of Construction Materials Since 1913
Trend of Materials Prices
Construction Cost Index Number—Derivation and Values
Construction Volume Index Number Since 1913
Trend of Labor in the United States
Contracts Let During 1921 Total $1,231,370,565 in Value
Municipal Bond Sales in 1921 Top All Previous Records

by the Citizens' Committee. Every encouragement is awarded by the Committee to employers and employees alike who abide by the decision, but violators on both sides are being severely dealt with. Building activities in Chicago are rapidly approaching normal.

New York — The current building trade's wage rate will probably remain in force until after Apr. 1, 1922. The heaviest increase in unemployment is noticeable in the building trades as compared with other industries. This is especially true of structural ironworkers and those dependent upon large unit construction. Much of this is due to seasonal conditions as recent totals of contracts awarded in this district have been unusually large.

San Francisco—The new decision of the Impartial Wage Board of the Industrial Association of San Francisco has reduced bricklayers and structural ironworkers from $1.16 to $1.12½; carpenters, hoisting engineers and pile drivers from $1.03 to $1 and hod-carriers from 92½c. to 75c. per hour. Common laborers are rated at $4.50 and skilled laborers at $5 per day, this rate applying to union labor; common, unskilled, non-union labor probably receives not more than 45c.@55c. per hour.

Conditions in the Brick Industry

A marked improvement in the brick industry, as compared with a year ago, is noted in current reports from manufacturers, according to the digest issued by the Common Brick Manufacturers of America under date of Jan. 1. Today the proportion of orders on the books to stocks on hand is 68.9 per cent, whereas a year ago the figure was 41.5 per cent. In proportion to the number of firms reporting, the stocks on hand are approximately the same as a year ago, a difference in the relation of the two items resulting from a much greater volume of business on the books. "The outlook for the brick manufacturer," says the digest "is in every way more favorable than it was a year ago."

The price of brick per thousand at the plant Jan. 1, 1921, ranged from $14 to $28, while today the range is from $10 to $20, the higher price now applying only to high-grade brick made in New England, which is commonly used for facing purposes. As an indication, only, of the general drop in price the composite price now stands at $13.47, which is about 50 per cent lower than a year ago. The price is more stable and better equalized throughout the country.

Continuing the digest says: "The industry has for three months experienced a slight improvement in demand, which shows no sign of slumping, and which promises at the resumption of building in the spring to approach a point nearer normal than was attained at any time during 1921." In contrast to the feeling with which the brick manufacturers faced 1921 the digest reports that "it is believed that few manufacturers will feel any hesitancy in making plans for opening their plants as early in the new year as possible."

Contracts for Week Ended Dec. 29

The total contracts let for the week ended December 29, as reported in *Engineering News-Record*, were valued at $19,548,068. The table appearing on p. 13 of this issue, reviewing contracts for the year, contained an estimate of $20,000,000 for the value of contracts let during the week ended December 29, so the total for the year contains but a small error.

Monthly Prices of Construction Materials

Ups and Downs of the Market

War Tax on Freight—Cancellation of 3 per cent transportation tax effective Jan. 1, 1922.

Pig Iron—Eastern Pennsylvania No. 2X quoted in Philadelphia at $22.26 as against $23.26 per gross ton.

Railway Supplies—Light rails quoted at a maximum of $32, Pittsburgh, as compared with $33 per 100 lb. one month ago. Standard section angle bars down 35c. in Pittsburgh and 48c. in Chicago. Reduction of 23c. per 100 lb. on spikes and track bolts quoted in Chicago.

Pipe—Discounts on all sizes black and galvanized wrought steel pipe increase 2½ points, on the Pittsburgh basing card, since last month. No change in wrought iron pipe discounts. Reduction at the mill reflected in increased steel pipe discounts at New York warehouses. Cast iron pipe prices generally firm. Heavy declines in sewer pipe prices in St. Louis; lighter reductions in Montreal and Philadelphia. Slight advance in larger sizes in Baltimore.

Road and Paving Materials—Road oil (65 per cent asphalt) advance ½c.; binder and flux decline ½c. per gal. in New York. Asphalt in package drops $1 in New York, $2 in Seattle and St. Louis and $3 in Baltimore; advance $2 per ton in Philadelphia. Asphalt in bulk drops $1 in New York, $2 in St. Louis and advances 50c. per ton in Philadelphia. Granite paving stone down 15c. in Baltimore and 5c. per sq.-yd. in St. Louis. Wood paving blocks up 70c. in St. Louis; down 40@50c. in New Orleans and 15c. per sq.yd. in Baltimore.

Sand, Gravel and Crushed Stone—Sand down 10c. per cu.yd. in Philadelphia and Cincinnati and 40c. per ton in Baltimore; no advances. Gravel, ¾-in., up 5c. per ton in St. Louis and 2c. per cu.yd. in Philadelphia; down 53c. per cu.yd. in Cincinnati. Gravel, ½-in., down 5c. per ton in St. Louis; 87½c. per cu.yd. in Cincinnati, 76½c. in New Orleans and up 10c. per cu.yd. in Philadelphia. Crushed stone up 10c. in St. Louis and down 5c. per cu.yd., ¾-in. size, in Philadelphia.

Lime and Cement—Hydrated finishing lime drops $1.50 and hydrated common $1 per ton in Philadelphia. Common lump lime quoted at $3@$3.49 as against $3.39@$3.69 per bbl. (280 lb. net) in New York; $11 per ton as compared with $15, one month ago, in Montreal and a reduction from $11 to $9.50 per ton in Philadelphia. Natural (Utica) cement advances 16c. per bbl. in Cincinnati. Portland cement up 23c. in St. Louis and 32c. in New Orleans; down 10c. in New York, 9c. in Boston, 14c. in Atlanta, 38c. in Baltimore, 2c. in Montreal and 27c. per bbl. in Philadelphia.

Structural Material—Steel shapes, plates and bars still quoted at $1.50@$1.60 per 100 lb., Pittsburgh mills. Birmingham mills quote shapes and plates at $1.75 as against $1.90 and bars at $1.65 as compared with $1.75 one month ago. During the last month steel shapes have dropped from $3.70 to $3.45 in San Francisco; structural rivets from $3.70 to $3.50 and cone head boiler rivets from $3.80 to $3.60 per 100 lb. in New York warehouses. Blue annealed steel sheets, base size, quoted at $3.28 as against $3.53 per 100 lb. in New York. Wire nails down 40c. at Pittsburgh mill, 35c. in Chicago and 50c. per keg in San Francisco warehouses. Expanded metal lath reduced $3 per 100 yd. in New York; slight declines in Chicago. Reductions ranging from 6c. to 40c. per 100 sq.ft. in triangle mesh at Pittsburgh mill.

Brick and Hollow Tile—Common brick quoted at $14@$15 per 1,000 wholesale, New York, as against $15 last month. Brick down $1 in St. Louis, $2 in Minneapolis, $2.50 in San Francisco and up $1 per 1,000 in Cincinnati. Hollow building tile declines in Philadelphia, St. Louis, Boston, Minneapolis, Cincinnati, Denver, Baltimore and New Orleans; up in Montreal and Dallas.

Roofing Materials—Average drop of 10c. per square in No. 1 and No. 2 grades prepared roofings, in New York and Philadelphia. Slate roofing and shingles also decline. Drop of 20c. per roll in tar felt and $5 per ton in both light and heavy asphalt felt in Philadelphia.

Lumber—Average advance of $3 per M ft. b.m. in Douglas fir in San Francisco yards. Long leaf yellow pine, base sizes, up $1.50 in New York and down $1 in Chicago. Pine shows general upward trend in Baltimore and Birmingham and declines in Dallas. Douglas fir up in Los Angeles, Denver and Minneapolis and down in Seattle and Philadelphia. Hemlock advances in Los Angeles and Minneapolis and declines in Boston and Philadelphia. Spruce down in Boston and Philadelphia.

Steel Sheet Piling—Pittsburgh quotes $1.80 as against $1.80@$1.90 per 100 lb.

Manila Rope—Advances averaging 1c. per lb. in Boston, Minneapolis, Atlanta, New Orleans, Los Angeles and Seattle; declines in Cincinnati, Philadelphia and Baltimore.

Explosives—Decline of 2c. on 40 per cent and 60 per cent gelatin dynamite in St. Louis; 10c. on 40 per cent and 11c. on 60 per cent in Montreal and an advance of 2c. per lb. on 60 per cent in Los Angeles.

Linseed Oil—Down 2c. per gal. in Chicago since last month. Prices stable elsewhere.

Price advances since last month are indicated by **heavy type**; declines by *italics*

PIG IRON—Per Gross Ton—Quotations compiled by The Matthew Addy Co.:

	Current	One Year Ago
CINCINNATI		
No. 2 Southern (silicon 2.25 @ 2.75)	$22.50†	$46.50
Northern Basic	22.02†	40.00
Southern Ohio No. 2 (silicon 1.75 @ 2.25)	23.52†	47.00
NEW YORK, tidewater delivery		
Southern No. 2 (silicon 2.25 @ 2.75)	28.50†	52.10
BIRMINGHAM		
No. 2 Foundry (silicon 2.25 @ 2.75)	18.00†	42.00
PHILADELPHIA		
Eastern Pa., No. 2X, (2.25@2.75 sil.)	*22.26*†	46.00*
Virginia No. 2 (silicon 2.25 @ 2.75)	28.74†	46.25†
Basic	20.75†	44.00*
Grey Forge	22.50†	45.50*
CHICAGO		
No. 2 Foundry Local (silicon 1.75 @ 2.25)	21.70†	43@45
No. 2 Foundry Southern (silicon 2.25 @ 2.75)	24.66†	46@48
PITTSBURGH, including freight charge from the Valley		
No. 2 Foundry Valley (silicon 1.75 @ 2.25)	22.46†	44.00
Basic	20.96†	38.00
Bessemer	21.96†	42.00

*F.o.b. furnace. † Delivered.

RAILWAY SUPPLIES

STEEL RAILS—The following quotations are per ton f.o.b. Pittsburgh and Chicago for carload or larger lots. For less than carload lots 5c. per 100 lb. is charged extra:

	Pittsburgh			
	Current	One Year Ago	Birmingham	Chicago
Standard bessemer rails	$40.00	$45.00	.....	$40.00
Standard openhearth rails	40.00	47.00	$40.00	40.00
Light rails, 8 to 10 lb.	31.00@*32.00*	2.45@3.00*	1.60*	1.65@1.80*
Light rails, 12 to 14 lb.	31.00@*32.00*	2.41@2.95*	1.60*	1.65@1.80*
Light rails, 25 to 45 lb.	31.00@*32.00*	2.32@2.85*	1.60*	1.65@1.80*

*Per 100 lb.

RAILWAY TIES—For fair-sized orders, the following prices per tie hold:

	6 In. x 8 In. by 8½ Ft.	7 In. x 9 In. by 8 Ft. 6 In.
Chicago, White Oak	$1.35	$1.50
Chicago, Hardwood and Red Oak	1.20	1.30
Chicago, Empty Cell Creosoting (add'l)	.45	.50
San Francisco, Green Douglas Fir	.75	.97
San Francisco, Empty Cell Creosoted, Douglas Fir	1.70	2.20

For ties on standard "railroad administration" specifications, f.o.b. cars, St. Louis:

	White Oak	Red Oak	Pine and Sap Cypress
Grade 3	$1.15	$1.05	$0.95
Grade 2	1.05	.95	.85
Grade 1	.95	.85	.75

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh					
	Current	One Year Ago	Chicago	St. Louis	San Francisco	Birmingham
Standard spikes, ½-in. and larger	$2.25	$3.65@3.90	*$2.65*	$3.60	$4.50	$4.05
Track bolts	3.25@3.50	5.50@6.00	*3.65*	4.60	5.50	4.15
Standard section angle bars	*2.40*	2.75@3.75	*2.40*	3.25	4.00	3.25

PIPE

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

BUTT WELD

Inches	Steel Black	Steel Galv.	Inches	Iron Black	Iron Galv.
1 to 3	71	58½	⅜ to 1¼	44½	29½

LAP WELD

2	64	51½	2	39½	25½
2 to 6	68	55½	2½ to 6	42½	29½
7 to 8	65	51½	7 to 12	40½	27½
9 to 12	64	50½			

BUTT WELD, EXTRA STRONG, PLAIN ENDS

2 to 1½	69	57½	1 to 1½	44½	30½
1 to 3	70	58½			

LAP WELD, EXTRA STRONG, PLAIN ENDS

2	62	50½	2	40½	27½
2½ to 4	66	54½	2½ to 4	43½	31½
4½ to 6	65	53½	4½ to 6	42½	30½
7 to 8	61	47½	7 to 8	35½	23½
9 to 12	55	41½	9 to 12	30½	18½

STEEL—From warehouses at the places named the following discounts hold for steel pipe:

	Black		
	New York	Chicago	St. Louis
1 to 3 in. butt welded	66%	60%	56½%
2½ to 6 in. lap welded	61%	57%	53½%

	Galvanized		
	New York	Chicago	St. Louis
1 to 3 in. butt welded	53%	46%	42½%
2½ to 6 in. lap welded	47%	43%	39½%

Malleable fittings, Class B and C, from New York stock sell at list less 5%. Cast iron, standard sizes, 32% off.

CAST-IRON PIPE—The following are prices per net ton for carload lots:

	New York					
	Current	One Year Ago	Birmingham	Chicago	St. Louis	San Francisco
4 in.	$50.30	*$73.30*	$38.00	$46.60@48.30	$46.20	$54.00
6 in. and over	47.30@48.30	*63.30*	35.00	42.60@44.10	43.20	50.00

Gas pipe and Class "A," $3 per ton extra; 16-ft. lengths, $1 per ton.

CLAY DRAIN TILE—The following prices are per 1000 lin.ft.:

	New York					
Size, In.	Current	One Year Ago	St. Louis	Chicago	San Francisco	Dallas
3	$40.00	$62.00	$35.00	$50.00	.....	$55.00
4	50.00	77.50	85.00	60.00	$90.00	65.00
5	80.00	110.00	140.00	80.00	115.00	84.00
6	105.00	140.00	140.00	100.00	150.00	110.00
8	175.00	228.00	200.00	150.00	250.00	181.00

SEWER PIPE—The following prices are in cents per foot for carload lots:

Size, In	New York Delivered	Pittsburgh	Birmingham	St. Louis	Chicago	San Francisco	Dallas
3	$0.14	$0.087	.....	*$0.0475*	$0.12	$0.12	.....
4	.14	.087	$0.09	*.0675*	.12	.15	$0.18
5	.21	.1305	.....	*.0945*	.18	.18	.165
6	.21	.1305	.135	*.1225*	.18	.21	.25
8	.35	.203	.225	*.20*	.28	.30	.35
10	.52	.3045	.....	*.21½*	.42	.42	.....
12	.67	.3915	.3825	*.36*	.54	.54	.80
15	1.15	.522	.5625	*.649*	.72	.90	.....
18	1.55	.725	.765	*.948*	1.00	1.32	.....
20	1.98	.87	1.125	*.9823*	1.20	.....	.....
22	2.64	1.16	.....	.....	1.60	.....	.....
24	2.97	1.305	1.4625	*1.20*	1.80	2.16	2.40
27	4.50	1.885	.....	*2.00*	3.75	3.00	.....
30	5.00	2.088	3.20	*2.65*	4.75	3.60	.....
33	6.55	2.61	.....	*3.30*	5.50	.....	.....
36	7.50	2.9725	.....	*3.65*	6.00	.....	.....

	3	5	8	12	24	36
Boston	$0.108	$0.162	$0.252	$0.486	$1.62	$4.92
Minneapolis	.....	.....	.40	.77	2.55	5.66
Denver	.....	.15	.30	.50	1.95	.....
Seattle	.145	.....	.36	.72	2.59	.....
Los Angeles	.11*	.165*	.275	.495	1.65	.....
New Orleans	.....	.108	.27	.459	1.755	.....
Cincinnati	.10	.15	.233	.45	1.50	4.305
Atlanta	.098*	.147*	.245	.4165	1.5925	.....
Montreal, *delivered*	.30*	.45*	.70*	1.35	4.50	6.50
Detroit	.105	.1575	.245	.4725	2.115	5.4325
Baltimore (*f.o.b.*)	.1225	.2275	.35	.6875	2.29	5.25
Kansas City, Mo	.15	.21	.335	.60	2.41	4.74
Philadelphia	.095	.145	.220	.425	1.44	4.50

*4-in., 6-in., 9-in., respectively.

ROAD AND PAVING MATERIALS

ROAD OILS—Following are prices per gallon in tank cars 8,000 gal. minimum f.o.b. place named:

	Current	One Year Ago
New York, 45% asphalt (at terminal)	$0.05½	$0.10
New York, 65% asphalt (at terminal)	.05½	.09
New York, binder (at terminal)	.07½	.09
New York, flux (at terminal)	.06	.09
New York, liquid asphalt (atterminal)	.06½	.11
St. Louis, 50-60% asphalt (*f.o.b.*) *Tulsa, Okla.*	.01½*	.12
Chicago, 40-50% asphalt	.05	.08½
Chicago, 60-70% asphalt	.05½	.08½
Dallas, 40-50% asphalt	.10	.10
Dallas, 60-70% asphalt	.13	.13
Dallas, 75-90% asphalt	.15	.15
San Francisco, binder, per ton	15.00†	15.00

* Freight $21.75 per ton to Whiting, Ind.
† F.o.b. Oleum, Cal. Freight to San Francisco, 80c. per ton.

ASPHALT—Price per ton in packages (350-lb. bbls. or 425-lb. drums) and in bulk in carload lots:

	Package	Bulk
New York (Bayonne, N. J.)	*$25.00*	*$16.00*
Boston	No quotations	
Chicago	25.85	19.50
San Francisco, *f.o.b. refinery*, Oleum, Cal.	21.50*	15.00*
Dallas	35.00	27.00
Seattle	*25.50*	21.50
Denver	45.00	65.00
Minneapolis	.....	20.50
St. Louis	*26.00*	*20.00*
Baltimore	*25.00*	20.00
Los Angeles, *at factory*	22.50	15.00
Montreal	28.00	21.00
Atlanta	27.50	....
Detroit (petroleum asphalt)	24.50	20.00
Cincinnati	26.10	21.80
Maurer, N. J. (natural asphalt)	36.00	33.00
Maurer, N. J. (artificial asphalt)	22.00	20.00
Philadelphia	24.00	17.00

*Freight to San Francisco, 80c. per ton.

NOTE—Barrels or drums are optional in most cities. About 6 bbls. to the ton, and from 4 to 5 drums. Rebates of about $1 per bbl., no rebate for drums.

PAVING STONE—

New York	5-in. granite, 28@29 blocks per sq.yd.	$130.00 per M
Chicago	About 4x8x4 dressed	3.35 sq.yd.
	About 4x8x4 common	3.00 sq.yd.
San Francisco	Basalt block 4x7x8	65.00 per M
Boston	5-in. granite	125.00 per M
Atlanta	Granite	2.00 sq.yd.
Detroit	Granite, 26½ blocks per sq.yd.	107.00 per M
Baltimore	Granite	*2.00* sq.yd.
Montreal	Granite	125.00 per M
New Orleans	Granite, 4 x 8 x 4	3.25 sq.yd.
Cincinnati	Granite	4.30 sq.yd.
St. Louis	4x8x4 dressed	*3.30* sq.yd.
	4x8x4 common	*2.95* sq.yd.
Kansas City	No. 1 Granite	3.95 sq.yd.
Philadelphia	Granite	125.00 per M.

FLAGGING—

New York	Bronx	$0.25 sq.ft.
	Manhattan, 4 ft.	.26 sq.ft.
	Queens, 5 ft.	.26 sq.ft.
	6x20-in. cross-walk	1.00 lin.ft.
Chicago	18 in. wide	.99 lin.ft.

CURBING—Bluestone per lineal foot, in New York, costs 77c. for 5x16 in., 88c. for 5x18 in.; in cargo lots.

WOOD BLOCK PAVING—

	Size of Block	Treatment	Per Sq.Yd.
New York	3	16	$2.09
New York	3½	16	2.17
New York	4	16	2.37
Boston	3	16	2.17
Chicago	4	16	3.00@3.25
Chicago	3½	16	2.50@2.75
St. Louis	3½	16	3.20
St. Louis	4	16	3.70
Seattle	4	16	Off market
Minneapolis	3½	16	2.13
Atlanta	3½	16	2.30
New Orleans	3	16	*1.60*
New Orleans	3½	16	*1.80*
New Orleans	4	16	*2.00*
Dallas	4	18	3.90
Baltimore	3½	16	*3.45*
Montreal	4	16	4.50
Detroit	3	16	2.84
Detroit	4	16	3.00
Cincinnati	4	16	2.60
Kansas City	4	16	2.15
Philadelphia	3½	16	3.50

CONSTRUCTION MATERIALS

SAND AND GRAVEL—Price for cargo or carload lots is as follows, per cu.yd.:

	Gravel 1½ In. Current	Gravel 1½ In. One Year Ago	Gravel ¾ In. Current	Gravel ¾ In. One Year Ago	Sand Current	Sand One Year Ago
New York	$1.75	$3.00	$1.75	$3.00	$1.00	$1.50
Denver	2.50	2.00	2.50	1.80	1.10	1.60
Chicago	2.00	2.75	2.00	2.75	2.00	2.75
St. Louis, *per ton*	*1.25*	1.65	1.30	1.70	1.20	1.70
Seattle	1.50	1.50	1.50	1.50	1.50	1.50
Dallas, *delivered*	*2.00*	2.50	*2.00*	2.50	*2.00*	2.00
Minneapolis, *at pit*	1.50	2.00	1.50	....	.50	1.00
Cincinnati, *at pit*	*1.00*	2.00	*1.50*	2.00	*1.50*	2.00
San Francisco	2.25	2.50	2.25	2.50	1.50	1.65
Boston, per ton	2.65	2.60	2.65	2.60	2.00	1.60
New Orleans	*2.08‡*	3.60	*2.08‡*	....	1.35	1.85
Los Angeles, per ton	1.35†	1.25	1.35†	1.25	1.20†	1.15
Atlanta, per ton	1.85	2.50	1.85	....	1.25	1.50
Detroit	2.00	1.85*	2.00	1.85*	2.00	3.50
Baltimore, per ton	1.40	1.40‡	1.60	1.60‡	*2.00*	.70
Montreal, per ton	1.25	1.50‡	1.50	....	1.25	1.25‡
Birmingham, per ton (Crushed slag used instead of gravel)					1.28	1.25‡
Philadelphia	1.50	....	1.57	....	*1.80*	....

* Fine white sand: Pacific, $4 per ton; Ottawa, $4.50

† Freight from quarry to Los Angeles is 70c. per ton, and is included in above price.

‡ Per cu. yd.

CRUSHED STONE—Price for cargo or carload lots f.o.b. city, unless stated otherwise, is as follows, per cu.yd.:

	1½ In. Current	1½ In. One Year Ago	¾ In. Current	¾ In. One Year Ago
New York	$1.80@1.90	$1.90@2.00	$1.80@1.90	$2.15
Chicago	1.60	2.75	1.60	2.75
St. Louis *delivered*	1.65*	1.89	1.65*	1.89
Dallas, *delivered*	*2.93*	2.50	*2.93*	2.50
San Francisco	2.25	2.50	2.25	2.50
Boston, *delivered*	3.00*	3.00* (del.)	3.00*	3.00* (del.)
Minneapolis, *at plant*	2.00	2.00	2.25	2.25
Kansas City	2.75	2.35	2.75	2.35
Denver	3.50	....	3.50	....
Seattle *delivered*	3.00	3.50 (del.)	3.00	3.50 (del.)
Atlanta	*2.00**	3.00	2.00*	3.25
Cincinnati *delivered*	2.37½	2.30	2.08	2.15
Los Angeles	1.60*	1.60*	1.70*	1.70*
Detroit	1.90*	2.00	1.90*	2.00*
Baltimore	1.75*	1.75*	1.65*	1.75*
Montreal	2.00*	1.75*	2.10*	1.75*
Birmingham *delivered*	3.20	....	3.10	....
Phildelphia	1.70*	....	*1.55**	....

*Per ton.

CRUSHED SLAG—Price of crushed slag in carload lots, per net ton, at plants:

	1½-In.	¾-In.	Roofing	Sand
Youngstown District	$1.30	$1.30	$2.00	$1.30
Steubenville District	1.40	1.40	2.00	1.40
Ironton District	1.40	1.40	2.00	1.40
Emporium, Pa.	1.25	1.25	....	1.25
Easton, Catasaqua, Pa.	1.00	1.00	2.00	0.90
Birmingham, Ala.	0.75	0.95	2.05	0.80
Buffalo, N. Y., and Erie, Pa.	1.25	1.25	2.25	1.25
Cleveland, Ohio	1.20	1.20	....	1.00
Eastern Pennsylvania and Northern New Jersey	1.20	1.20	2.50	1.20
Western Pennsylvania	1.25	1.25	2.50	1.25

LIME—Warehouse prices:

	Hydrated, per Ton Finishing	Hydrated, per Ton Common	Lump, per 180-Lb. Barrel (net) Finishing	Lump, per 180-Lb. Barrel (net) Common
New York	$16.99	.....	....	*$3.00@3.40**
Chicago	18.00	.....	....	1.40
St. Louis	0.58	$0.50	$2.25	0.70†
Boston	23.00	20.00	3.35	3.10
Dallas	25.00	.....	....	2.75
Cincinnati	18.40	16.00	19.00‡	....
San Francisco	22.00	18.00	....	1.90
Minneapolis	29.00	22.00 (white)	*1.70*	1.40
Denver	30.00	.....	95†	2.95
Detroit	15.25	13.25	11.50‡	10.50‡
Seattle	27.00	.....	3.25	2.75
Los Angeles	30.00	30.00	3.00*	3.00*
Baltimore	15.00	13.00	....	12.00‡
Montreal	21.00	21.00	15.00‡	*11.00‡*
Atlanta	19.00	16.00	2.00	*1.50*
New Orleans	....	17.25	1.75	1.75
Philadelphia	*13.00*	*11.50*	10.50	*9.50‡*

* 280-lb. barrels (net). † Per bushel. ‡ Per ton.—Refund of 10c. per barrel. Minneapolis quotes brown lime; Kelly Is. white is $1.70, Sheboygan *$1.55*. St. Louis quotes hydrated lime per 50-lb. sack. Seattle quotes hydrated finishing lime in cloth sacks; paper sacks, $24.00 per ton.

NATURAL CEMENT—Price to dealers per bbl. for 500 bbl. or over, f.o.b., exclusive of bags:

	Current	One Year Ago
Minneapolis (Rosendale)	$2.80	$1.85
Kansas City (Ft. Scott)	1.60	1.60
Atlanta (Magnolia)	11.00 ton	1.90
Cincinnati (Utica)	1.93	*2.75*
Boston (Rosendale)	.85@.95	2.35

PORTLAND CEMENT—Prices to contractors per bbl. in carload lots f.o.b. points listed *without bags* Cash discount of 10c. per bbl. for payment within 10 days from date of invoice, not deducted.

	Current	One Month Ago	One Year Ago
New York*	*$2.30*	$2.40	$3.50
New York, alongside dock to dealers	2.00	2.00	....
Jersey City	*2.12*	2.13	3.20
Boston	*2.52*	2.61	3.41
Chicago	1.97	1.97	2.37
Pittsburgh	2.02	2.02	2.42
Cleveland	2.28	2.28	2.73
Detroit	2.31	2.31	2.68
Indianapolis	2.23	2.23	2.61
Toledo	2.31	2.31	2.71
Milwaukee	2.19	2.19	2.59
Duluth	1.95	1.95	2.35
Peoria	2.14	2.14	2.63
Cedar Rapids	2.28	2.28	2.71
Davenport	2.22	2.22	2.67
St. Louis	2.20	1.97	3.45
San Francisco	2.84	2.84	3.09
New Orleans	3.20	2.88	4.20
Minneapolis	2.26	2.26	2.71
Denver	3.10	3.10	3.25
Seattle	3.10	3.10	3.03
Dallas	2.55	2.55	3.85
Atlanta	*2.55*	2.69	3.00
Cincinnati	2.37	2.37	2.77
Los Angeles	3.31	3.31	3.10
Baltimore*	*2.50*	2.88*	2.93*
Birmingham	2.27	2.27	....
Kansas City	2.45	2.45	2.76
Montreal*	*3.10*	3.12*	3.52 (inc. bags)
Philadelphia	*2.23*	2.50*	....

NOTE—Bags 10c. each. 40c. per bbl.; 80c. per bbl. in Montreal;

Current mill-prices per barrel in carload lots, without bags; to contractors:	
Buffington, Ind	$1.70
Universal, Pa	1.75
Steelton, Minn	1.75
Fordwick, Va	1.95
Hudson, N. Y	1.90
Kingsport, Tenn	1.95
Lehigh Valley District	1.70
Richard City, Tenn	1.95

*Delivered by truck at site of work.

TRIANGLE MESH—Price per 100 sq.ft. in carload lots:

PLAIN ¼-INCH BY 4-INCH MESH

Style Number	Weight in Pounds	Pittsburgh, Mill	New York (Warehouse)	Chicago	Dallas	San Francisco
032	22	$0.68	$1.13	$0.87	$1.15	$1.24
049	28	.87	1.40	1.05	1.46	1.56
068	35	1.05	1.67	1.27	1.80	1.92
093	45	1.35	2.11	1.63	2.30	2.46
126	57	1.65	2.58	2.02	2.86	3.07
153	68	1.97	3.05	2.40	3.40	.....
180	78	2.26	3.48	2.76	3.93	.....
245	103	2.99	4.55	3.63	5.15	.....
287	119	3.45	5.25	4.20	5.96	6.41
336	138	4.00	6.07	4.87	7.32	.....
395	160	4.64	7.01	5.65	8.00	.....
			PAVING			
036P	.17	$0.52	$0.88	$0.62	$0.88	.....
053P	.24	.73	1.20	0.88	1.24	.....
072P	.31	.91	1.48	1.11	1.57	.....
097P	.40	1.18	1.87	1.43	2.02	.....
049R	.24	.73	1.20	.....	1.24	.....
067R	.31	.91	1.48	.....	1.57	.....
089R	.40	1.18	1.87	.....	2.02	.....

Made in 16-, 20-, 24-, 28-, 32-, 36-, 40-, 44-, 48-, 52- and 56-in. width in rolls 150-, 200- and 300-ft. lengths. Galvanized is about 15% higher.

EXPANDED METAL LATH—Prices in carload lots per 100 yd. for painted are as follows:

Gage	Weight	*New York	Chicago	St. Louis	San Francisco	Dallas
27BB	2.3	$21.20	$23.36	$23.39	$27.62	$25.50
26BB	2.5	22.65	24.90	.....	29.21	27.56
25BB	3.0	25.30	27.42	27.45	.....	30.71
24BB	3.4	27.10	29.33	29.33	35.73	33.16
22PO	4.33	31.75	34.06	.....	.....	35.10

* Price to contractors at warehouse or delivered on job in Manhattan, Bronx or Brooklyn.

BARS, CONCRETE REINFORCING—Current quotations per 100 lb.:

ROLLED FROM BILLETS

Inches	*Pittsburgh Mill	Birmingham Mill	Warehouse, Uncut: New York	Chicago	St. Louis	Dallas	San Francisco
½ and larger	$1.50	$1.65	$2.68	$2.68	$2.87	$3.50	$3.00
⅝ and larger	1.55	1.75	2.73	2.73	2.92½	3.55	3.05
¾ and larger	1.60	1.75	2.78	2.78	2.97½	3.60	3.10
⅞ and larger	1.75	1.90	2.83	2.93	3.12½	3.75	3.25
1 and larger	2.00	1.90	2.88	3.18	3.37½	4.00	3.50

* Pittsburgh mill prices on large tonnages only.

Includes 15c charge for cutting to lengths of 2 ft. and over.

Twisted bars cut to length take extra of 27½c. per 100 lb.

ROLLED FROM RAILS

	Chicago	St. Louis	Dallas		Chicago	St. Louis	Dallas
½ and larger	$1.85	$1.90	$3.25	⅝	$2.00	$2.15	$3.50
⅝ in.	1.80	1.95	3.30	¼	2.25	2.40	3.75
¼	1.75	2.00	3.35	.....	.....	.....	.....

BRICK—Contractors price per 1,000 in cargo or carload lots is as follows:

	Common: Current	One Month Ago	One Year Ago	Paving Block: 3-inch*	4-inch*
New York (del.)	$17.40@18.40	$18.40	$22.70	$44.50	$49.50
New York (at dock)	14@15	15.00	.....	.....	.....
Chicago	11.00	11.00	15.00	34.00	42.00
St. Louis, salmon	16.00	17.00	17.00	.....	.....
Denver, salmon	14.00	14.00	15.00	.....	.....
Dallas	12.65	12.72	25.00	44.00	.....
San Francisco	15.50	18.00	18.00	.....	44.38
Los Angeles	15.50	15.50	13.50	(not used)	
Boston (del.)	17.00	17.00	30.00	46.50	52.60
Minneapolis (del.)	15.00	17.00	24@26	.....	43.00
Kansas City	14.50	14.50	22.00	.....	.....
Seattle	14.00	14.00	19.00	48.00	53.50
Cincinnati	19.00	18.00	22@23	41.00	.....
Montreal (del.)	16.00	16.00	20.00	100.00	120.00
Detroit (del.)	15.00	15.00	20.00	41.30	44.00
Baltimore (del.)	20.00	20.00	20@25	36.00‡	.....
Atlanta	9.00	9.00	20.00	40.00	.....
New Orleans	14.00	14.00	25.50	.....	.....
Birmingham	11.50	11.50	.....	.....	.....
Philadelphia	16.00	16@19	.....	.....	42.00

* For paving blocks 3½x8½x3 and 3½x8½x4 respectively. ‡ Vitrified, f.o.b. plant, Baltimore.

HOLLOW TILE—Price per block in carload lots to contractor for hollow building tile.

	New York: Current on Trucks*	New York: One Year Ago	Chicago	Philadelphia	St. Louis	San Francisco	Perth Amboy N. J., Factory
4x12x12	$0.11120	$0.2444	$0.0821	$0.130	$0.08	$0.145	.....
6x12x12	.16670	.3259	.0950	.180	.13	.20	.....
8x12x12	.20840	.4345	.1295	.230	.145	.315	$0.17890
10x12x12	.....	.....	.1584	.305	.200	.....	.21050
12x12x12	.....	.....	.1811	.385	.230	.....	.27370

* 5 per. off for cash.

	4x12x12	8x12x12	12x12x12
Boston	$0.0960	$0.182	$0.248
Minneapolis (f.o.b. cars)	.0672	.105	.168
Minneapolis (delivered)	.0752	.1175	.188
Cincinnati	.0670	.126	.175
Kansas City	.085	.167	.270
Denver	.08	.145	.21
Seattle	.10	.175	.30
Los Angeles factory	.103	.185	.22
New Orleans	.13	.26	.40
Detroit (delivered)	.070	.135	.225
Montreal	.20	.30	.35
Baltimore	.15	.25	.40
Atlanta	.0675	.13	.....
Dallas	.13	.....	.....
Birmingham	.095	.1785	.....

San Francisco and New York quote on hollow partition tile.

STRUCTURAL MATERIAL—Following are base prices f. o. b. mill, Pittsburgh and Birmingham together with quotations per 100 lb. from warehouses at places named:

	*Pittsburgh, Mill	Birmingham Mill	New York (del.)	Dallas	St. Louis	Chicago (del.)	San Francisco
Beams, 3 to 15 in.	1.50	$1.75	$2.78	$4.00	$2.97½	$2.88	$3.45
Channel, 3 to 15 in.	1.50	1.75	2.78	4.00	2.97½	2.88	3.45
Angles, 3 to 6 in., ¼ in. thick	1.50	1.75	2.78	4.00	2.97½	2.88	3.45
Tees, 3 in. and larger	1.50	1.75	2.78	4.00	2.97½	2.88	3.45
Plates	1.50	1.75	2.78	4.00	2.97½	2.88	3.45

* Pittsburgh mill price on large tonnages; small tonnages $1.60 per 100 lb.

RIVETS—The following quotations are per 100 lb.:

STRUCTURAL

	Warehouse: Pittsburgh, Mill	New York: Current	New York: One Yr. Ago	Chicago	St. Louis	San Francisco	Dallas
½ in. and larger	$2.25@2.40	$3.50	$5.75	$3.43	$3.77½	$5.50	$5.50

CONE HEAD BOILER

½ in. and larger	2.35@2.50	3.60	6.00	3.53	3.87½	5.60	5.65
⅝ and ¾	2.50@2.75	3.76	6.15	3.68	3.87½	5.75	5.80
⅞ and 1	2.75@2.90	4.00	6.40	4.18	3.87½	6.00	6.05

Lengths shorter than 1 in. take an extra of 50c. Lengths between 1 in. and 2 in. take an extra of 25c.

NAILS—The following quotations are per keg from warehouse:

	Pittsburgh, Mill	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire	$2.50@2.75	$3.25	$4.40	$5.00	$3.48	$4.95
Cut	2.25	6.10	6.00	7.75	4.08	5.00

PREPARED ROOFINGS—Standard grade rubbered surface, complete with nails and cement, costs per square as follows:

	New York: 1-Ply l.c.l.	New York: 2-Ply l.c.l.	New York: 3-Ply l.c.l.	Philadelphia: 1-Ply l.c.l.	Philadelphia: 2-Ply l.c.l.	Philadelphia: 3-Ply l.c.l.
No. 1 grade	$2.08	$2.38	$2.80	$1.92	$2.28	$2.70
No. 2 grade	1.77	2.08	2.45	1.67	1.98	2.15

Slate-surfaced roofing (red and green) in rolls of 108 sq.ft. costs $1.90 per roll in carload lots and $2.15 for smaller quantities f.o.b. Philadelphia.

Shingles, red and green slate finish, cost $5.40 per square in carloads; $5.65 in smaller quantities, in Philadelphia.

ROOFING MATERIALS—Prices f.o.b. New York:

Tar felt (14 lb. per square of 100 sq.ft.) per roll of 432 sq.ft.	$2.15
Tar pitch (in 400-lb. bbl.), per 100 lb.	1.85
Asphalt roofing (in barrels), per ton, f.o.b. plant*	47.50
Asphalt felt (light), per ton, f.o.b. plant*	72.00
Asphalt felt (heavy), per ton, f.o.b. plant*	73.50

* Delivered in Metropolitan Dist., $3.00 additional.

SHEETS—Quotations are per 100 lb. in various cities from warehouse also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	St. Louis	Chicago	San Francisco	New York
No. 10	$2.25	$2.87½	$3.38	$5.25	$3.28
No. 12	2.30	2.92½	3.43	5.30	3.33
No. 14	2.35	3.97½	3.48	5.35	3.38
No. 16	2.55	3.07½	3.58	5.45	3.48
Black					
*Nos. 18 and 20	2.85	3.95	3.95	5.55	3.80
*Nos. 22 and 24	2.90	4.00	4.00	5.60	3.85
*No. 26	2.95	4.05	4.05	5.65	3.90
*No. 28	3.00	4.15	4.15	5.75	4.00
Galvanized					
No. 10	3.00	4.15	4.15	.....	4.00
No. 12	3.10	4.25	4.25	5.95	4.10
No. 14	3.10	4.25	4.25	5.95	4.10
Nos. 17 to 21	3.40	4.55	4.55	6.25	4.40
Nos. 22 and 24	3.55	4.70	4.70	6.40	4.55
*Nos. 25 and 26	3.70	4.85	4.85	6.55	4.70
*No. 28	4.00	5.15	5.15	6.85	5.00

*For painted corrugated sheets add 30c. per 1,000 lb. for 5 to 28 gage; 25c. for 19 to 24 gages; for galvanized corrugated sheets add 15c., all gages.

LINSEED OIL—These prices are per gallon:

	New York: Current	New York: One Year Ago	Chicago: Current	Chicago: One Year Ago
Raw in barrel (5 bbl. lots)	$0.72	$0.95	$0.74	$1.25

WHITE AND RED LEAD—Base price in cents per pound:

	Red — Current		Red — 1 Year Ago		White — Current Dry or In Oil	White — Yr. Ago Dry or In Oil
	Dry	In Oil	Dry	In Oil		
100-lb. keg	12 25	13.75	14.00	15 50	12 25	14.00
25 and 50-lb. kegs	12 50	14.00	14 25	15 75	12 50	14 25
12½-lb. keg	12 75	14 25	14 50	16 00	12 75	14 50
5-lb. cans	15 25	16 75	17 00	18 50	15 25	17 00
1-lb. cans	17 25	18.75	19 00	20 50	17 25	19.00

LUMBER

Prices wholesale to dealers in carload lots, f.o.b.

San Francisco—Prices of rough Douglas fir No. 1 common, in more than carload lots:

Lumber Prices to Contractors in Yards at San Francisco

	6–8 and 12 Ft.	10–16–18 and 20 Ft.	22 and 24 Ft.	25 to 32 Ft.
3x3 and 4	$28 00	$31 00	$34 00	$36 00
3x6 and 8	28 00	31 00	32 00	34 00
4x4-6 and 8	30 00	33 00	34 00	36 00
3x10 and 12	30 00	32 00	34 00	36 00
3x14	31 00	33 00	35 00	37 00
4x10 and 12	32 00	34 00	36 00	38 00
4x14	33 00	35 00	37.00	39.00

	24 Ft. and Under	25 to 32 Ft.	33 to 40 Ft
6x10	$33 00	$35 00	$37 00
6x14	35 00	37 00	39 00
8x10	33 00	35.00	37 00
3x14	35.00	37.00	39 00

New York, Chicago, St. Louis and Detroit—Wholesale prices to dealers of long leaf yellow pine.

	New York* 20 Ft. and Under	New York* 20–24 Ft.	Chicago 20 Ft. and Under	Chicago 22–24 Ft.
3x 4 to 8x8	$38 00	$39 00	*$39.00*	*$41.00*
3x10 to 10x10	41 00	42.00	*41.00*	*43.00*
3x12 to 12x12	44 00	45 00	*43.00*	*45.00*
3x14 to 14x14	47 50	48 50	*47.00*	*49.00*
3x16 to 16x16	52 50	53 50	*52.00*	*54.00*
3x18 to 18x18	60 00	61 00	*58.00*	*60.00*
4x20 to 20x20	70 00	71 00	*65.00*	*67.00*

* Wholesale price to dealers; to contractors, on lighters or cars, about $5 additional. Short leaf pine up to 14 x 14 costs $15 per M. less.

St. Louis: Yellow pine, 10@12 ft. long, 3 x 4 to 6 x 6, $20.00; 3 x 8 to 8 x 8, $19; 3 x 12 to 5 x 12, $25; 3 x 14 to 5 x 14, $28; 3 x 16 to 4 x 16, $32; 12 x 14 to 14 x 14, $27.

Detroit—Norway pine 2 in. x 4 in., 10 ft. x 16 ft. long, $35, 2 in. x 12 in., 10 ft. x 16 ft. long, $37; short leaf yellow pine 2 in. x 4 in., 9 ft. x 12 ft. long, $27.50 2 in. x 8 in., 18 ft. x 20 ft. long, $31; yellow pine flooring No. 1 common 1 in. x 3 in., $39.75, 1 in. x 4 in., 6 ft. x 12 ft. long, $37.25; yellow pine shiplap $37.00.

Over 24 ft.—Add $1 for each additional 2 ft. in length up to 30 ft. for sizes 12 x 12 and under, for sizes over 12 x 12 add $2, for merchantable add $2 to sizes 10 x 10 and under. For pine add $2 to the price of merchantable for all sizes.

Other Cities

	8 x 8-In. x 20 Ft. and Under — P.	Fir	Hemlock	Spruce	12 x 12-In. 20 Ft. and Under — P.	Fir
Boston	$50 00	$52.00	$55.00	*$45.00*	*$54.00*	$52 00
Seattle		*18.00*	.....	.....	.....	*19.00*
New Orleans	28 00	.....	.....	.....	*25.00*	.....
Baltimore	36 50	.....	.....	.....	38 50	.....
Cincinnati	42 00	50 00	.....	.....	46 00	64 00
Montreal	78 00	85 00	68 00	78 00	120 00	100 00
Los Angeles	.....	44 00	43 00	.....	.....	44 00
Denver		35 75	.....	.....	50 00	36 75
Minneapolis	40 00	40 00	37 00	.....	47.00	38 00
Atlanta	30 00	.....	.....	.....	38 00	.....
Dallas	33 00	.....	.....	.....	*34.00*	.....
Kansas City	33 00	29.50	47.00	.....	38 00	33.00
Birmingham	20 00	.....	.....	.....	26 00	.....
Philadelphia	*38.00*	*38.50*	*41.50*	*42.50*	*45.00*	*43.00*

	1-In. Rough, 10 In. x 16 Ft. and Under — P.	Fir	Hemlock	2-In. T. and Gr. 10 In. x 16 Ft. — P.	Fir
Boston	$47 00	$48 00	*$32.00*	$45 00	$48 00
Seattle	.....	*13.00*	.....	.....	*14.00*
New Orleans, at mill	65 00	.....	.....	32 00	19 50
Baltimore	35 00	.....	.....	36 50	.....
Cincinnati	62.50	80 00	.....	33 50	.....
Montreal	120.00	60 00	60 00	80 00	80 00
Los Angeles	.....	39 00	38 00	.....	63 00
Denver	.....	30 25		.....	29 75
Minneapolis	38 50	34 25	33 25	36 00	32 75
Atlanta	19 00	.....	.....	22 00	.....
Dallas	32 00	30 00	.....	36 00	.....
Kansas City	36 00	33 00	.....	32 50	31 00
Birmingham	18 00	.....	.....	18 00	.....
Philadelphia	35.00	36.00	35.00	33.00	33.00

Montreal—Up to 32 ft.; over which, $3.00 per M. increase up to 30 ft.

Birmingham—Quotes carload lots, f.o.b. sidings. $2 additional per M. ft. for delivery.

Boston and Cincinnati—Prices to contractors in carload lots, f.o.b.

Denver—Quotes dealers prices to contractor on large projects.

FREIGHT RATES

On finished steel products in the Pittsburgh district, including plates, structural shapes, merchant steel, bars, pipe fittings, plain and galvanized wire nails, rivets, spikes, bolts, flat sheets (except planished), chains, etc., the following freight rates are effective in cents per 100 lb., in carloads of 36,000 lb.:

Baltimore	$0.33½	Detroit	$0.32½
Birmingham	.76½	Kansas City	.81½
Boston	.41½	New Orleans	.51½
Buffalo	.29½	New York	.38
Chicago	.38	Pacific Coast (all rail)	1.66½†
Cincinnati	.325	Philadelphia	.35
Cleveland	.24	St. Louis	.47½
Denver	1.35*	St. Paul	.66½

* Minimum carload, 40,000 lb.

†Minimum carload, 50,000 lb., structural steel only; 80,000, lb. for other iron or steel products.

CONTRACTORS' SUPPLIES

STEEL SHEETPILING—The following price is base per 100 lb. f. o. b. Pittsburgh, with a comparison of a month and a year ago:

Current	One Month Ago	One Year Ago
$1.80	$1.80@1.90	$3.00

WIRE ROPE—Discounts from list price on regular grades of bright and galvanized are as follows:

	Eastern Territor New York and East of Missouri River
Hercules red strand, all constructions	25%
Patent flattened strand, special and cast steel	25%
Patent flattened strand, iron rope	10%
Plow steel round strand rope	40%
Special steel round strand rope	35%
Cast steel round strand rope	27½%
Round strand iron and iron tiller	10%
Galvanized steel rigging and guy rope	12½%
Galvanized iron rigging and guy rope	+7½%

California, Oregon, Nevada and Washington Discount 5 points less than discount for Eastern territory.

Wyoming, New Mexico and Colorado: Discount 5 points less than discount for Eastern territory.

Arizona: Discount 10 points less than discount for Eastern territory.

Montana, Idaho and Utah: Discount 10 points less than discount for Eastern territory.

North Dakota, Nebraska, Kansas, Oklahoma and Texas: Discount 5 points less than discount for Eastern territory.

MANILA ROPE—For rope smaller than ½-in. the price is ½ to 2c. extra; while for quantities amounting to less than 600 ft., there is an extra charge of 1c. The number of feet per pound for the various sizes is as follows: ½-in., 8 ft., ¾-in., 6; ⅞-in., 4½; 1-in., 3½; 1¼-in., 2 ft. 10 in.; 1½-in., 2 ft. 4 in. Following is price per pound for ½-in. and larger, in 1200-ft. coils:

Boston	$0 20	New Orleans	$0.17½
New York	.18½	Los Angeles	.16½
Chicago	18	Seattle	.17
Minneapolis	.19½	St. Louis	.18½
San Francisco	.16	Montreal	.30
Atlanta	21½	Detroit	.175
Denver	18	Baltimore	.20
Cincinnati	17	Kansas City	.17½
Dallas	29	Birmingham	.20½
Philadelphia	17½		

EXPLOSIVES—Price per pound of dynamite in small lots:

	Gelatin 40%	Gelatin 60%
New York	$0.3075	$0.3425
Boston	.24	.275
Kansas City	.26	.295
Seattle	.1875	.2125
Chicago	.2275	.2525
Minneapolis	.2274	.2530
St. Louis	.24	.27
Denver	.2350	.2700
Dallas	.29	.375
Los Angeles	.25	.29
Atlanta	.2675	.3025
Baltimore	.2550	.27
Cincinnati	.2275	.2725
Montreal	.22	.26
Birmingham, *delivered*	.165	.205
New Orleans	.2725	.3075
San Francisco	.195	.23
Philadelphia	.2525	.2875

PILES—Prices per lineal foot, pine piles with bark on, f.o.b. New York.

Diameters	Points	Length	Barge	Rail
12 in. at butt	6 in.	30 to 50 ft.	$0.14	$0.19
12 in.—2 ft. from butt	6 in.	50 to 59 ft.	0.18½	0.25
12 in.—2 ft. from butt	6 in.	60 to 69 ft.	0.21	0.27½
14 in.—2 ft. from butt	6 in.	50 to 69 ft.	0.24	0.32½
14 in.—2 ft. from butt	6 in.	70 to 79 ft.	0.26	0.34½
14 in.—2 ft. from butt	5 in.	80 to 89 ft.	0.33	0.42

SCRAP—The prices following are per gross ton paid to dealers and producers in New York. In Chicago and St. Louis the quotations are per net ton and cover delivery at the buyer's works, including freight transfer charges.

	New York	Chicago	St. Louis
No. 1 railroad wrought	$10 50	$11 50	$13.50
Stove plate	10 50	12 00	13 50
No. 1 machinery cast	16 50	13 50	16 00
Machine shop turnings	3 00	00	6.50
Cast borings	3 75	5 50	8.50
Railroad malleable cast	9 50	12.50	11 00
Re-rolling rails	11.50	13.00	12 00
Relaying rails	30.00	30.00	27.00

SHIP SPIKES—Current prices per 100 lb.:

In.	San Francisco — Galv.	San Francisco — Black	Seattle Black
½	$9.10	$8.40	$8.55
⅝	8.65	6.65	8.25
¾	8.50	6.50	8.30